THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LIII. No. 1356.] LONDON, MAY 7, 1889. [41ST YEAR. Price 6d.

Ashmore, Benson, Pease, & Co., Ltd.

GASHOLDERS.
CONDENSERS.
SCRUBBERS.
PURIFIERS.
RETORT-APPLIANCES.
CONSTRUCTIONAL IRONWORK.

STOCKTON-ON-TEES.

Illustrated Gas-Works Catalogue.

— ESTABLISHED 1830. —
PARKER & LESTER,
Manufacturers & Contractors.

THE ONLY MAKERS OF
PATENT ANTIMONY PAINT,
Parker's Imperial Black Varnish,
Oxide Paints, Oils, and General Stores for Gas and Water Works.

WORKS:
ORMSIDE STREET, OLD KENT ROAD, LONDON.

WOLSTON'S
TORBAY PAINTS
TORBAY & DART PAINT Co., LIMITED,
23, GREAT GEORGE ST., WESTMINSTER, S.W.

CEMENT
EARLE'S
BEST
PORTLAND CEMENT
MANUFACTURED BY
GEO. & THOS. EARLE,
HULL.
PROMPT DESPATCH:
Seven Jetties on the River.
Two Private Railway Sidings.
FACILITIES FOR DESPATCH:
Six Railway-Waggon Entrances with Steam and Hydraulic Cranes.
Four Rully Entrances.
Three different Railway Companies within easy carriage distance.
Storage Capacity 8000 tons.
Office: 7, PIER STREET.
Works: WILMINGTON.
ESTABLISHED 1811—OVER THREE QUARTERS OF A CENTURY.

SIMON'S
AMMONIA PLANT FOR GAS-WORKS.

Improved Continuous Distillation. Extracts all Ammonia.
Produces either Sulphate or Liquor Ammoniæ. No Clogging with Lime.

This Apparatus has been successfully at work for years in over 100 Establishments in England, Germany, France, and America.

HENRY SIMON, 20, MOUNT STREET, MANCHESTER.

C. & W. WALKER.

GASHOLDERS; PURIFIERS;
PURIFYING MACHINES;
CO_2 AND TAR-EXTRACTING WASHERS; SCRUBBERS;
SULPHATE & SULPHUR PLANT;
RETORT MOUTHPIECES; CONDENSERS;
LIFTING APPARATUS; CENTRE AND FOUR-WAY VALVES;
SLIDE VALVES; TAR BURNERS; &C., &C.,
WOOD SIEVES.

ADDRESSES:
8, Finsbury Circus, London, E.C.; Midland Works, Donnington, Salop.
"FORTRESS LONDON," "FORTRESS DONNINGTON."—Telegraphic.

FLETCHER AND MURPHY,

GARRATT STREET WORKS, OLDHAM ROAD, MANCHESTER,

Manufacturers of

IMPROVED CONSUMER'S WET GAS-METERS

IN CAST-IRON CASES,

THE UNVARYING WATER-LINE GAS-METER,

AND

IMPROVED DRY GAS-METERS;

STATION METERS OF ALL SIZES, with PLANED JOINTS;

GOVERNORS, PRESSURE AND EXHAUST REGISTERS, TEST HOLDERS,

And all kinds of Experimental Gas Apparatus.

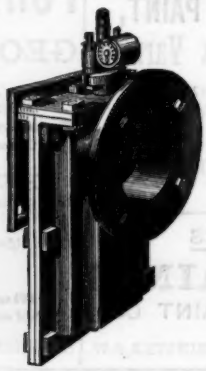
S. OWENS & CO., Hydraulic, Gas, & General Engineers, WHITEFRIARS ST., LONDON, E.C.

SOLE MANUFACTURERS OF

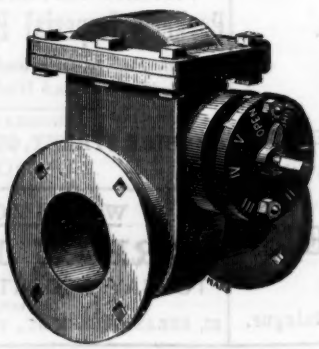
MANN & OWENS' PATENT SCREW & CAM, also FULL-WAY RACK & PINION GAS-VALVES.

REDUCED IN PRICE.

VALVE to OPEN DOWNWARDS.



BRIDGE VALVE
for Regulating the Seal of Hydraulic Mains.



FULL-WAY RACK AND PINION VALVE.

VALVE to OPEN UPWARDS.

Also Makers of Pillar Valves, Self-acting Bye-pass Valves, Outside Rack and Pinion Valves, Hydraulic Main-Valves, Disc-Valves, and Special Valves of all kinds. Improved Gas-Exhausters, Steam-Engines, Steam-Cranes, Boilers. Blake's Patent Steam-Pumps for Tar, Water, and Ammoniacal Liquor. Hydraulic Coal-truck Lifts, Hydraulic Cranes, Hydraulic Apparatus for Lifting Purifier-Covers, and every description of Pumping Apparatus, &c., suitable for use in Gas-Works, made to order.

S. O. and Co.'s New Catalogue of Gas Apparatus and General Machinery can be had on application.

NEWTON, CHAMBERS, & CO., LIMITED,

THORNCLIFFE IRON-WORKS, NEAR SHEFFIELD,

MANUFACTURERS OF

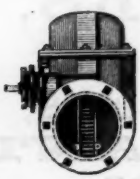
SLIDE VALVES,
With Rack & Pinion,
or
Internal or External
SCREWS, of all Sizes.

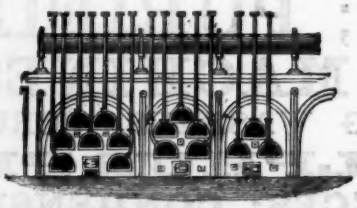
GASHOLDERS,
AND
Gasholder Tanks.

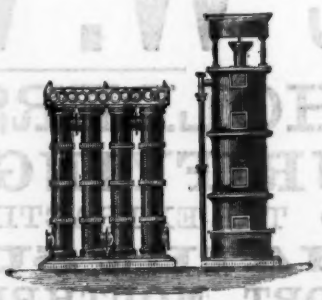
CAST-IRON RETORTS,
RETORT-BED FITTINGS,
AND RETORT-HOUSE APPLIANCES
of every description.
Iron Roofs, Columns, Girders, Floor Plates and Tools, &c.

WROUGHT AND CAST IRON
CONDENSERS, SCRUBBERS, & WASHERS
TAR AND LIQUOR PUMPS, &c.

PATENT
CENTRE VALVES
for working Purifiers.
Also Bye-Pass & Stop Valves.





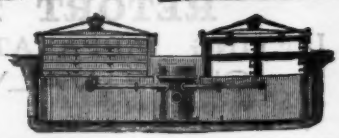


PURIFIERS with Planed Joints.

HAND and HYDRAULIC LIFTING GEAR, CAST-IRON MAINS and SPECIALS.

WOOD GRIDS.

CAST AND WROUGHT IRON TANKS AND CISTERNS.



DESIGNS, SPECIFICATIONS, AND ESTIMATES FREE.

Pig Iron (*Special Quality*) for ENGINE CYLINDERS, &c.

GAS COAL FAMOUS FOR ITS UNRIVALLED EXCELLENCE.

THE BARROWFIELD IRON-WORKS, LIMITED,

Late LAIDLAW, SONS, & CAINE, Limited,

GAS ENGINEERS AND CONTRACTORS,

Telegrams: "GASOMETER GLASGOW."

GLASGOW.

GAS APPARATUS OF EVERY DESCRIPTION.

RETORTS, CONDENSERS, SCRUBBERS, PURIFIERS.

GASHOLDERS AND TANKS.

ENGINES, EXHAUSTERS, STEAM BOILERS AND FITTINGS.

OIL PLANT AND CHEMICAL APPARATUS.

BRIDGES, GIRDERS, WHARVES, PIERS.

ROOFING OF EVERY STYLE.

PIPES, VALVES, AND CONNECTIONS.

London Office: 6, LITTLE BUSH LANE, CANNON STREET.

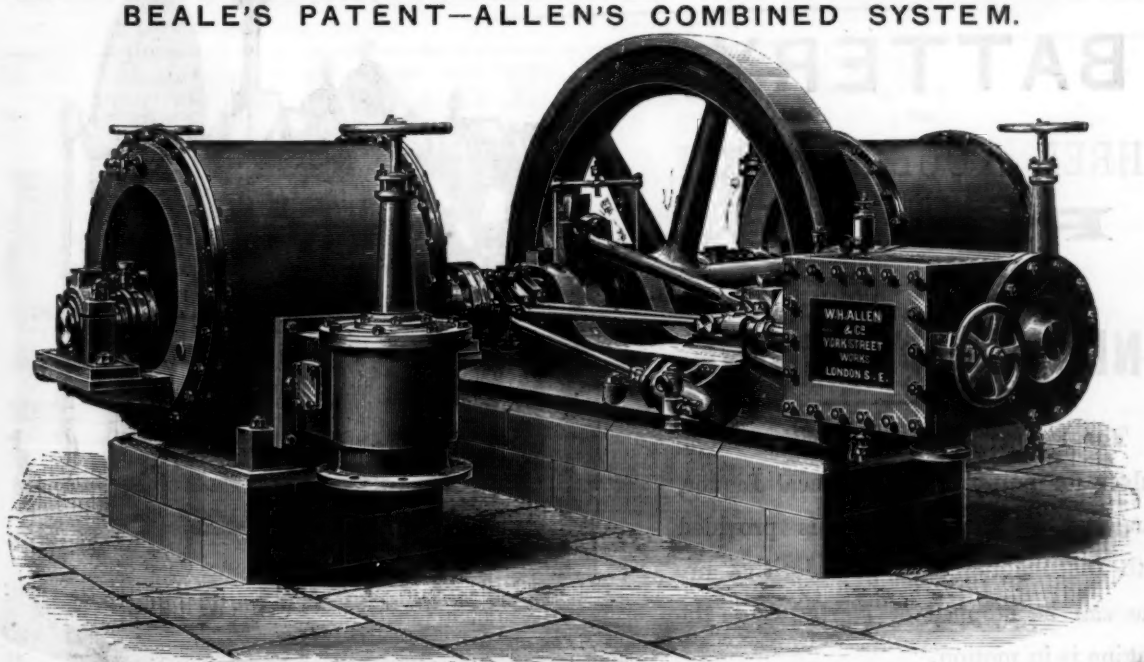
W. H. ALLEN & CO.,

York Street Works, LAMBETH, LONDON, S.E.,

MAKERS OF THE MOST IMPROVED FORM OF

GAS EXHAUSTING MACHINERY.

BEALE'S PATENT—ALLEN'S COMBINED SYSTEM.



Pair of Non-Oscillating Exhausters, passing 200,000 Cubic Feet of Gas per Hour.

SPENT LIMES NO LONGER WASTE PRODUCTS!

G. R. HISLOP'S PATENT REGENERATIVE PROCESS

MOST EFFECTIVELY AND *ECONOMICALLY RESTORES* LIME WASTES CONTINUOUSLY.

The Patentee having under his several Patents effected a complete solution of the Spent Lime difficulty, most confidently solicits the consideration of the fact by the Engineers and Managers of Gas Companies, Gas Corporations, and other SpentLime producers. The adoption of these Patents secures the following amongst other advantages, viz.:—1st. Nuisance is avoided, and the utmost convenience and comfort in Gas purification are secured. 2nd. The Lime is recovered at from one-third to one-half the cost of new Lime, or from 5s. 6d. to 7s. 6d. per Ton (depending on extent of works and working charges). 3rd. The Lime is either recovered for Building and Agricultural purposes, or specially and continuously for Gas purification—no limit being assigned to its durability. 4th. Nearly the whole of the valuable sulphur is collected and sold. 5th. By the Patentee's Improved Furnace, breeze or inferior cannel coke only is required as a fuel. The process has been worked for a considerable time by several important Gas Companies and Corporations throughout the Kingdom, and with the most satisfactory results. The Patentee erects, proves, and grants working on very moderate terms.

Further particulars may be had on application to A. F. Wilson, Esq., Assoc. M. Inst. C.E., 12, Walbrook, London, E.C., Agent for London; J. E. Fisher, Esq., Stourbridge, Agent for the rest of England, Wales, and Ireland; or to the Patentee—

GEO. R. HISLOP, Engineer, GAS-WORKS, PAISLEY, N.B.

HUTCHINSON BROTHERS,

GAS ENGINEERS AND CONTRACTORS, ETC.,

MANUFACTURERS OF

CONSUMERS' METERS IN CAST-IRON OR TIN CASES;

STATION METERS AND GOVERNORS;

LAMP METERS AND REGULATORS;

Pressure Gauges and Registers; Main Thermometers;

TEST-HOLDERS AND PROVING BENCHES;

EXHAUSTER REGULATORS;

MAIN, LAMP, AND SERVICE TAPS, UNIONS, ETC., ETC.

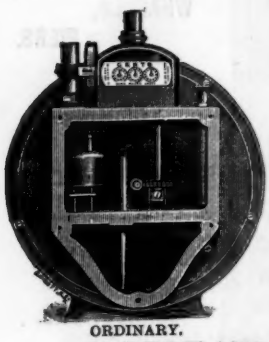
SULPHATE OF AMMONIA PLANT;

Improved Lead-Burning Apparatus;

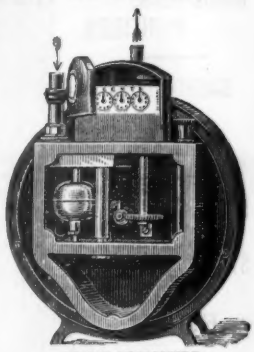
WROUGHT-IRON AND WOOD PURIFIER GRIDS;

SCRUBBER BOARDS;

IRON COKE-BARROWS; TOOLS AND SUNDRIES.



ORDINARY.



HIGH PRESSURE.

ALBERT WORKS, CHURCH STREET, DEARNE WORKS, OLD MILL, } BARNSLEY.

Telegrams: "HUTCHINSON BROTHERS, BARNSLEY."

R. & J. DEMPSTER,

ENGINEERS, IRONFOUNDERS, & CONTRACTORS,

GAS PLANT WORKS,

NEWTON HEATH, MANCHESTER.

BATTERY

OF

THREE DOUBLE-ACTION

Pumps

DRIVEN FROM

ONE STEAM-ENGINE.

The Pumps are provided with suitable Valves for pumping Ammoniacal Liquor, Tar, and Water; and each is provided with Disengaging Gear, in order that any one can be stopped or started while the Engine is in motion.

G. J. EVESON,

GAS COAL AND CANNEL CONTRACTOR,

PATENTEE OF

A SPECIAL COMPOUND

FOR THE CURE OF STOPPED ASCENSION-PIPES,

A couple of charges of which will clear a stopped pipe, and an occasional charge keeps them clean, and also increases the make per ton and the illuminating power.

PRICE AND PARTICULARS ON APPLICATION.

Head Office: CORPORATION STREET, BIRMINGHAM.

ESTABLISHED 1825.

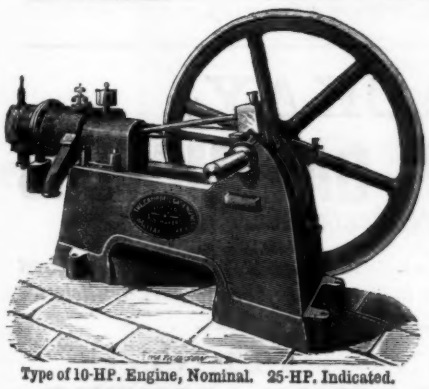
GAS TUBES

MANUFACTURERS OF EVERY DESCRIPTION OF

IRON OR STEEL LAP-WELDED OR BUTT-WELDED TUBES

FOR ANY PURPOSE.

THE "CAMPBELL" GAS-ENGINE.



Type of 10-HP. Engine, Nominal. 25-HP. Indicated.

GREAT SUCCESS.

20 PER CENT. CHEAPER THAN ANY OTHER.

Gives the Highest Satisfaction with all kinds of Work.

Testimonial from Mr. JAMES MOON, Engineer to the Filey Gas-Works.

Feb. 9, 1889.

GENTLEMEN,—We have been using one of your Gas-Engines on our Works for about four months, and I have pleasure in saying that it does its work in a very satisfactory manner. The engine is half-horse power, steady in all its movements, and, with ordinary care, will drive the exhaust apparatus at an even gauge.—I remain, Yours respectfully,

(Signed) JAMES MOON.

For Price Lists and full particulars, apply to the Sole Makers:

THE CAMPBELL GAS-ENGINE CO., LIMITED,

WELL LANE, HALIFAX, YORKS.

WILLEY AND CO.,

GAS ENGINEERING WORKS,

COMMERCIAL ROAD, EXETER.

London Offices: 6 & 7, KING WILLIAM STREET, E.C.

MANUFACTURERS OF EVERY DESCRIPTION OF

GAS APPARATUS.

GASHOLDERS, Telescope and Single-Lift, any size. Some of the largest in the Kingdom erected by this Firm are giving the highest satisfaction.

PLANS and SPECIFICATIONS furnished for **Extensions** and **Enlargement** of existing **Works,** adapting them to the most **Improved** and **Modern Principle** of **Gas Manufacture.**

PURIFIERS, CONDENSERS, WASHERS, ENGINES and EXHAUSTERS, STATION METERS and GOVERNORS, manufactured and erected.

Makers, by permission of that eminent authority **Mr. GEORGE LIVESEY,** of his **CELEBRATED PATENT WASHER,** highly approved by all the Engineers of Works where adopted. Largely in demand.

Special reference and attention are invited to our

WET AND DRY METERS,

which have acquired a high reputation for the **excellence** of Materials and Workmanship; their **durability** and **accuracy** of **Register** guaranteed. They are used by several of the **London Gas Companies,** and over **200 Provincial Gas Companies.**

Price Lists, Specifications, and Estimates provided for any work appertaining to Gas Lighting, from the Retort-House to the Drawing-Room.

R. DEMPSTER & SONS, LIMITED.,

MANUFACTURERS of GAS and CHEMICAL PLANT, ELLAND, YORKS.

VALVES OF ALL DESCRIPTIONS AND FOR ALL PURPOSES.

LARGE STOCK KEPT.

DIRECT-ACTING

RECIPROCATING

EXHAUSTERS.

ALL VALVES TESTED TO 40lbs. AND FLANGES FACED.

Prompt delivery guaranteed.

MAKERS OF LIVESEY'S PATENT WASHERS FOR THE COLONIES AND ABROAD.

JOHN BROTHERTON, LIMITED,

IMPERIAL TUBE WORKS,

WOLVERHAMPTON,

Paris Exhibition 1867. Amsterdam Exhibition 1883. Silver Medal and First-Class Certificate Bronze Medal and Special Diploma Adelaide Exhibition 1887. First Order of Merit and Medal.

MANUFACTURERS OF

WELDED IRON TUBES AND FITTINGS

FOR GAS, STEAM, WATER, &c.

LAP-WELDED TUBES

FOR LOCOMOTIVE, MARINE, AND STATIONARY BOILERS, AND OTHER PURPOSES.

HYDRAULIC AND HOT-WATER TUBES.

COILS OF ALL SIZES AND SHAPES.

Stocks, Taps, Dies, Taper Telegraph Poles, &c., &c.

London Offices: 3, Jeffrey Square, St. Mary Axe, E.C.

Paris Exhibition 1867. Calcutta Exhibition 1883 and 1884. Silver Medal and First-Class Certificate.

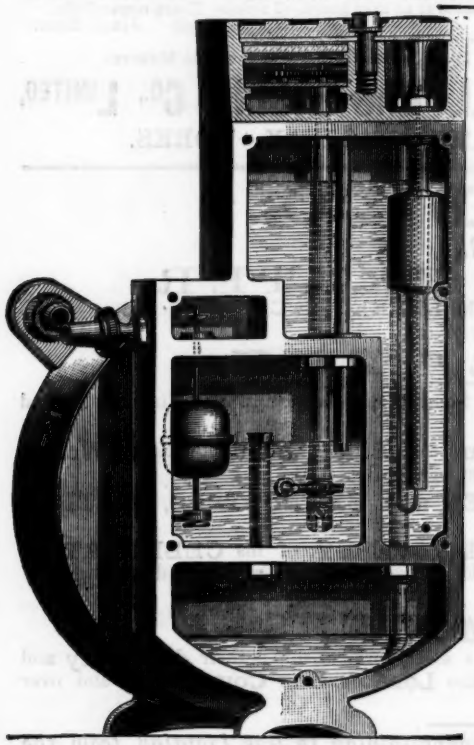
Telegraphic Address: "BROTHERTON, WOLVERHAMPTON."

ALDER AND MACKAY,

MANUFACTURERS OF

IMPROVED WET AND DRY GAS-METERS

IN CAST-IRON AND TIN CASES OF THE HIGHEST EXCELLENCE.



Sole Makers of Green's Patent Underground Wet Gas-Meters for Street Lighting, &c., and Ogden's Patent Spindle Tube for Wet Gas-Meters.

GREEN'S PATENT

UNDERGROUND METER

Has been designed to obviate that which has hitherto prevented the general adoption of underground Meters—namely, their serious cost. No box is required, and the saving thus effected as compared with ordinary underground Meters, where either a box or meter-pillar is necessary, is fully one-half. The price of one for three lights is 28s., and the other sizes are correspondingly cheap. When fixed, the only part of the Meter exposed to view measures 6½ inches by 8½ inches. By the Indicator with which the Meter is fitted, the Inspector can at once discern whether water is required; but as the Meter is of the compensating description, water will probably need only be supplied ONCE A YEAR. It is advisable to fill the Meter with a non-freezing liquid, which does not injure the fittings; and this can be supplied at about 1s. per gallon.

Prices and all Information on Application.

GRANGE WORKS, EDINBURGH.

HIGHEST AWARDS given for our WET and DRY METERS at

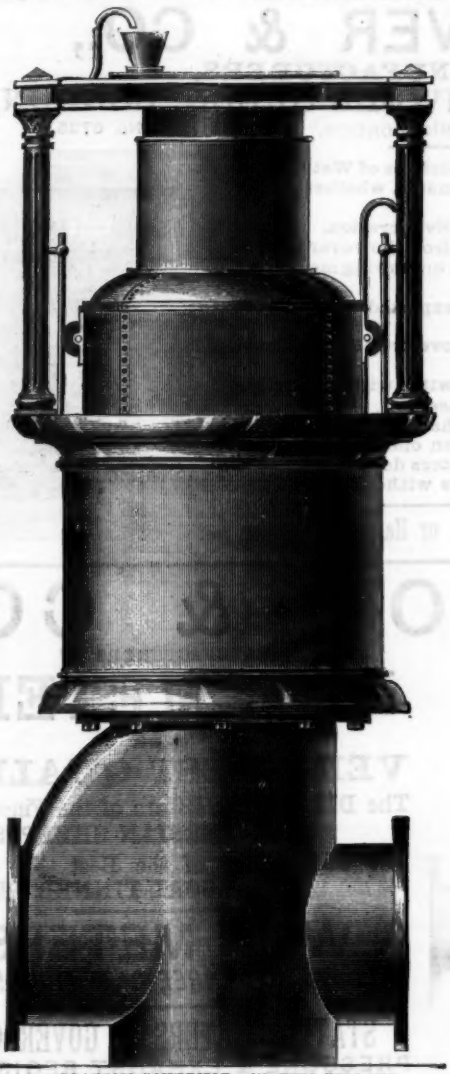
Exhibitions held at GLASGOW, CALCUTTA, and EDINBURGH.

WM. COWAN'S PATENT GAS GOVERNOR.

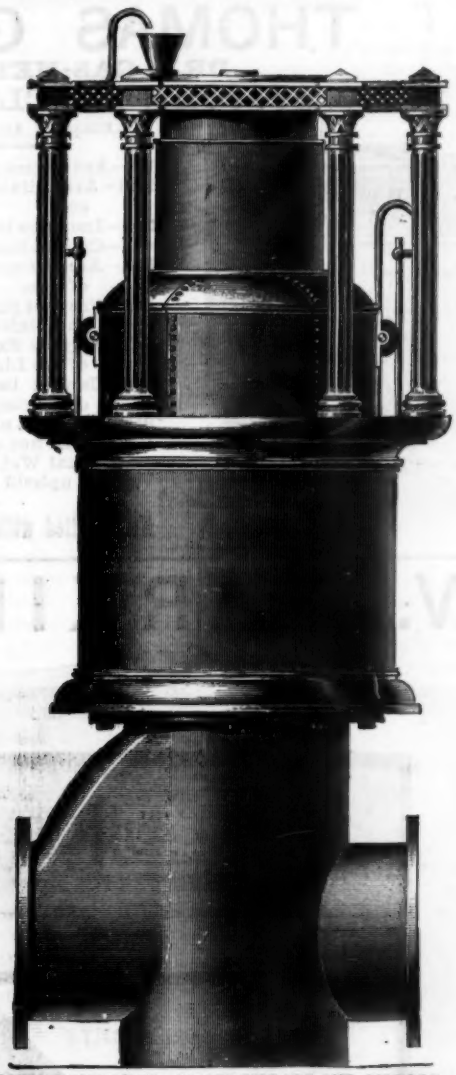
This Governor is a perfect regulator of gas pressure. Unaffected by **even the most extreme and sudden changes of inlet pressure or of draught,** it maintains, without variation, the pressure it is adjusted to give.

This result is attained by balancing the influence of the inlet pressure on the valve-base by an equivalent force, operating *above the roof of the bell.*

Another and a great advantage is the **unique water-loading arrangement,** which is made perfect and complete by the use of **WM. COWAN'S PATENT "STATIONARY SYPHON."**



STATION GOVERNOR with TWO PILLARS.



STATION GOVERNOR with SIX PILLARS AND GIRDERS.

The water loading is further utilized to maintain automatically the depth of the "seal" in the compensating slide. While the loading is going on, the water is first delivered into the slide, from which it overflows into the loading tank below.

We have supplied these Governors to many of the most important Gas-Works in the United Kingdom and abroad, to the Engineers of which we shall have pleasure in referring those who may favour us with inquiries.

W. & B. COWAN,

ESTABLISHED 1827

SMITH SQUARE WORKS, WESTMINSTER,	DUTTON STREET WORKS,	BUCCLEUCH STREET WORKS,
LONDON, S.W.	MANCHESTER.	EDINBURGH.

Established 1844.] **ORIGINAL MAKERS.** [Established 1844.

London, 1851. New York, 1853. Paris, 1855. London, 1862.

Dublin, 1865. Paris, 1867.

The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

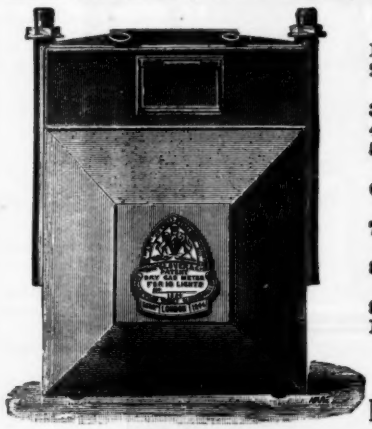
The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.
Since then we have not Exhibited for Prizes.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 to 222, ST. JOHN ST., CLERKENWELL GREEN, LONDON, E.C.

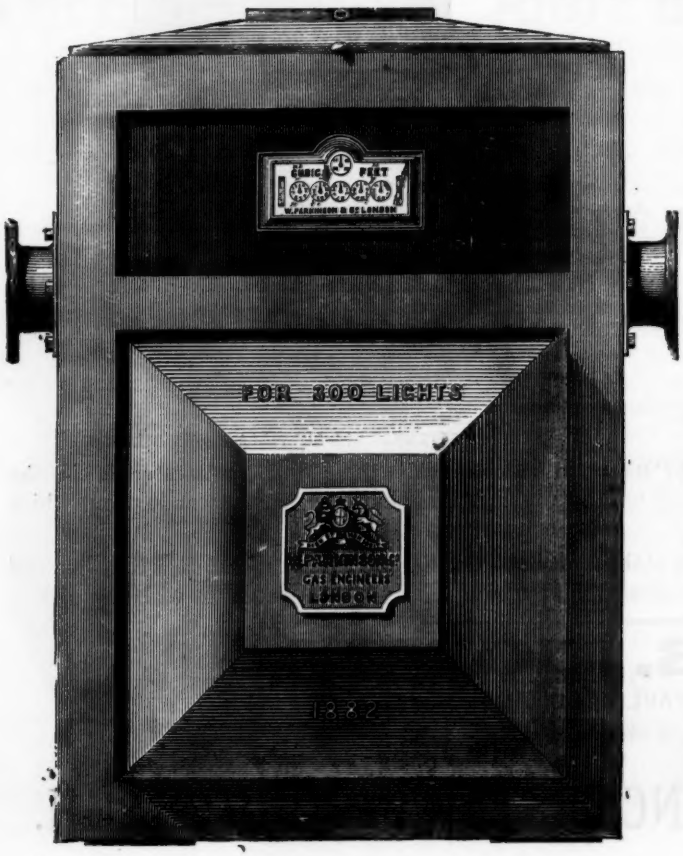
TELEGRAPHIC ADDRESS: "GOTHIC LONDON." TELEPHONE No. 6725.



1st—Are a remedy for all the defects of Wet Meters
2nd—Are suitable for all climates, whether hot or cold.
3rd—Incur no loss of Gas by Evaporation.
4th—Cannot become fixed by frost, however severe.
5th—Are the most accurate & unvarying measurers of Gas.
6th—Prevent jumping or unexpected extinction of the Lights.
7th—May be fixed either above or below the level of the Lights.
8th—Cannot be tampered with without visibly damaging the outer case.
9th—Will last much longer than Wet Meters.
10th—Will not cost more than one-half for repair that Wet or Water Meters do.
Are upheld for five years without charge.

Meters fitted with Grey's Index or Harding's Counter.

W. PARKINSON & CO.,



MANUFACTURERS OF

DRY METERS

OF THE

VERY BEST QUALITY.

The DIAPHRAGMS are of the Finest PERSIAN SHEEP SKINS.

The CASES are of the Best CHARCOAL-TINNED PLATES.

WET METERS,

With PATENT THREE-PARTITION DRUMS.

STATION METERS & GOVERNORS,

PRESSURE & EXHAUST REGISTERS.

MOTIVE POWER METERS,

Test Gasholders, Experimental Apparatus, &c.

PRESSURE GAUGES OF EVERY DESCRIPTION.

NEW ILLUSTRATED CATALOGUE & PRICE LIST
Sent post free on application.

GOLD & SILVER MEDALS.
International Health Exhibition, London, 1884.
SILVER MEDAL,
International Inventions Exhibition, 1885.

COTTAGE LANE, CITY ROAD, LONDON.

Telegraphic Address: "INDEX LONDON."

[See also Advt., p. 834.

CONTENTS.

EDITORIAL NOTES—*Gas, Lighting, &c.*:— PAGE
Mr. V. Wyatt on Tank Construction 845
The Board of Trade Returns relating to Gas Undertakings 845
Mr. Denny Lane on Gas and Electric Lighting 846
Water Gas in England and America 846
Gas Affairs in Dublin 846
Carelessness in Using Gas for Fuel 847
Water and Sanitary Affairs:—
The Consett Water Company and their Reservoir—The Right to Support Denied 848
The Supply of Water by Measure 848
ESSAYS, COMMENTARIES, AND REVIEWS:—
Gas and Water Companies in the Stock Market 849
Electric Lighting Memoranda 849
The Board of Trade Returns relating to Authorized Gas Undertakings . 850
A Seasonable Study—Paints. 851
NOTES:—
A Natural Gas Meter 852
The Archer Oil Gas Process. 852
The Creation or Diffusion of Fogs by Concussion. 853
COMMUNICATED ARTICLE:—
The Chemistry of Illuminating Gas. By Norton H. Humphrys, Assoc. M. Inst. C.E., F.C.S. 853
TECHNICAL RECORD:—
On Flame. By F. J. Rowan. 854
Ohio Gaslight Association—Annual Meeting at Mansfield 857
REGISTER OF PATENTS:—
Holders for Gas-Burners—Whitehead, D., and Ball, W. 858
Gas-Motors—Johnston, G. 858
Mouthpieces and Lids or Covers of Gas Retorts and other Vessels requiring Gas-Tight Joints—Westwood, W. H., and Wright, E. T. 858
Turning On and Off the Supply of Gas to the Wing Lights, Ground Rows, and Stages of Theatres—Tollerton, J. 858
Self Registering Water-Meters—Meinecke, H. 858
Patent Notices 858
CORRESPONDENCE:—
County Authorities and the Laying of Mains on Bridges 859
The Cost of Electric Light in Paris 859
Stapp's Water Gas 859
The "Lucient" Regenerative Gas-Lamps 859
Water Gas. 859
PARLIAMENTARY INTELLIGENCE:—
House of Lords—Progress of Bills. 860
House of Commons—Progress of Bills 860
LEGAL INTELLIGENCE:—
Supreme Court of Judicature—Court of Appeal—Consett Water-Works Company *v.* Ritson—Mining Operations under Reservoirs 860
High Court of Justice—
Chancery Division—Glover *v.* Gefle Gas Company, Limited 861
Queen's Bench Division—
Humphreys and Son *v.* The Southwark and Vauxhall Water Company 862
The Queen *v.* Mayor, &c., of Ramsgate—A Question of "Commission" 862
South Metropolitan Gas Company *v.* Noakes 862
Halifax Borough Police Court—The Assault upon a Gas Stoker 862
MISCELLANEOUS NEWS:—
Electric Lighting in the Metropolis—Board of Trade Inquiry 863
The Liverpool City Council and Electric Lighting 867
Halifax Corporation Gas Supply—The Recent Strike at the Gas-Works; The Gas Scandal. 867
Wigan Corporation Gas Supply—The Engineer's Annual Report; The Past Year's Working 868
Salford Corporation Gas Supply—Proposed Extension of the Works . . 869
Heywood Corporation Gas Supply—The Annual Balance Sheet; Reduction in Price 869
Burslem Corporation Gas Supply—The Past Year's Working; Increase in the Manager's Salary; Reduction in Price 870
Meeting of the Singapore Gas Company, Limited 870
The Public Lighting of Bristol 871
Gas and Meter Inspection in Canada. 871
Glasgow Corporation Water Supply—The Progress of the New Works at Loch Katrine 871
Notes from Scotland 872
Current Sales of Gas Products 873
Gas and Water Companies' Stock and Share List 873
The Gas Supply at Panama, 848—The Cost of Water-Works for Small Towns, 848—The Bailey Water-Works Engineer, 853—The Lighting of the Paris Exhibition, 853—Health Congress at Hastings, 853—The Water Gas Enterprise in England, 853—Contemplated Reduction in the Price of Gas at Manchester, 858—Southampton Gaslight Company, 858—Gas Exhibition at Workington, 858—Illumination at West Hartlepool, 859—Birmingham Gas-Fitters' Grievances, 859—Reading Public Lighting, 859—The Thirlmere Water-Works of the Manchester Corporation, 859—Torquay Water Supply, 859—Northern Coal Trade, 859—Derby Corporation Water Supply, 862—Douglas (Isle of Man) Water Supply, 862—The London Commissioners of Sewers and their Artesian Well, 862—The Condition of the Eccup (Leeds) Reservoir, 862—Tarapaca Water Company, Limited, 867—The Proposed Acquisition of the Mansfield Water-Works by the Improvement Commissioners, 870—Extension of Gas Lighting in the Colonies, 870—Additional Capital for the East Worcestershire Water Company, 870—The Proposed Electric Lighting of Folkestone, 871—The Bolton Corporation and Water Gas, 871—The Engineering Trades and the Proposed Private Bills Commission, 873—The Supply of Gas to Horwich, 873—Georgetown (British Guiana) Gas Company, Limited, 873—Accident at the Colchester Gas-Works, 873—Electric Lighting Experiment at Barnet, 873.

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MAY 7, 1889.

MR. V. WYATT ON TANK CONSTRUCTION.

THERE was no time last week to make more than the most cursory comment on Mr. V. Wyatt's suggestive paper, read before the North of England Gas Managers' Association, on the construction of gasholder tanks in concrete. It would be paying a poor compliment to the author, however, and an insufficient acknowledgment of the character of his communication on a most important subject, to pass it over without further remark. The paper should really be regarded in two independent aspects—first, as a statement from a master of construction on the general question of tank building; and, secondly, as a suggestion for the adoption of a new principle in concreting. Mr. Wyatt is able to throw a great deal of light upon the *rationale* of the ordinary methods of tank excavation and construction. All that he says about the apparent waste of excavation and consequent timbering of tank trenches, appeals to the natural instincts of engineers, who are constantly confronted with the cost of what is sometimes called the "false work" which is entailed in the execution of their designs. This is a general term applicable to every description of scaffolding, timbering, gantry work, and provisional erections generally, which go to the construction of underground and lofty structures. It would not be far wrong to say that whenever any important engineering work is in contemplation, the designer has to cudgel his brains to plan how to carry it out with the least amount of false work that can possibly be made use of. Sometimes the choice between one style of construction and another of equal intrinsic suitability must be determined by regard to the question of scaffolding, centring, &c. Mr. Wyatt's proposal for concrete tank building—to take the second aspect of his paper first into consideration—consists, if we understand it aright, in executing the work by what may be described as vertical panelling instead of ring work. This is a suggestion that does not recommend itself at first sight. It may be objected that as the earth must be got out somehow, it is not very clear how panelling is to materially reduce the quantity of excavation. Upon this head we can only refer to the text of the paper; for if the matter is not made intelligible there, we could not hope to do it by any paraphrase. The question is, of course, Is the point clear from the paper? While paying due respect to Mr. Wyatt's description, it is nevertheless regrettable that the point was not worked out with reference to some specific example, which would have carried conviction to the most sceptical. All that we desire to say upon the subject of panelling, apart from the question of excavation, is that the division of concrete work by vertical joints, although notched or in a way dovetailed, strikes one as not altogether in accordance with the traditional practice of such constructions. It may be correct; but it is at least slightly heterodox doctrine. It may be remarked, moreover, that the reliable assembling of hoop-iron or flat-iron bonding does not seem to be facilitated by the vertical panelling. As to the other aspect of Mr. Wyatt's paper, it may unhesitatingly be said to possess great value as a record of experience. It will be noticed that Mr. Wyatt favours the addition of sugar, and even of oatmeal, to cement, with a view to toughening the compound. A good deal has been written lately in engineering periodicals concerning the advantages of adding saccharine matter to lime mortar; but we had understood, chiefly from the observations of Mr. Faija, that sugar is likely to do rather more harm than good to Portland cement. As to the use of oatmeal, or starch in any form, it is probable that the expense would be a drawback. Mr. Bower, in the course of the discussion on the paper, said something about the use of iron oxide, or powdered mill scale, with concrete; and Mr. Wyatt supported the idea as being worth trying. It is interesting to take note of all suggestions of the kind; but, as a general rule, it would be desirable to be fully instructed, by ample experiment, on the action of all such admixtures, before relying upon them in any important work. It would be idle to make additions of foreign substances to concrete in such small quantities as to do neither good nor harm; and if used largely, it would be highly desirable that the operator should know perfectly well what he is doing.

THE BOARD OF TRADE RETURNS RELATING TO GAS UNDERTAKINGS.

IN another column will be found a detailed criticism of the last Board of Trade Returns relating to Gas Undertakings, which should go far to arouse the Department to a sense of the real character of their elaborate statistics. The question as to what is the object of these returns, the collection and production of which involve a great deal of trouble and no inconsiderable expense, although often asked, has never been authoritatively answered. Perhaps if Colonel Makins, M.P., or some other member of Parliament interested in the gas industry, were to take the ordinary course of moving the reduction of some Board of Trade vote by £500, in order to draw attention to this matter, the subject would receive some elucidation. Upon whatever grounds the collection of these returns may be justified, it would be difficult to meet the case which we put elsewhere—that while they continue to be published, the yearly issues should be prompt, the particulars given should be complete, and that above all the

figures should be accurate and unimpeachable. It is notorious that, at least in regard to the two first named conditions, the returns leave much to be desired. They are generally late—sometimes very much behind; and we have several times drawn attention to the absence of returns to the order of the House from different places. What compulsion is there to contribute statistics of this kind to the order of one of the Houses of Parliament? and what pains and penalties are incurred by the recipients of such orders when they are neglected? Unless the pretended collection of these statistics is to degenerate into a farce, the sooner this matter is set right the better. We imagine, however, that, while knowing the returns to be incomplete through the omission of all information respecting some gas undertakings, and the imperfect way in which the figures relating to others are given, those of our readers who have become accustomed to look upon the returns as a kind of financial directory of gas supply in the United Kingdom will be surprised to find, from the instances cited, that, for some reason or other, a great many of the data so formally published are utterly misleading. We have entered into some correspondence with the Board of Trade upon this subject, and trust that our interference, which has been actuated by the desire to see statements put forward on the authority of the Board made worthy of respect, may have the effect of arousing the officials of the Department to a better sense of their duty. Of course, the fault may not be theirs. If it is "the system" for Government Departments, when collecting statistical returns, to take unquestioningly everything that is sent to them, it will be useless for anybody to complain. All the same, it is as well that the facts of the matter should be understood. It may be true that the great totals would not be noticeably affected by the inclusion of returns relating to the gas supply of half-a-dozen of the little places that are wholly omitted, or by the correction of some of the smaller returns. This is not the point, however, which is that unless the returns are to be made reliable, they had better be discontinued. It is an old joke that there is nothing more misleading than facts, except figures; but if this reproach to statistics applies when these are properly prepared and otherwise unexceptionable, how much more appropriately may it be repeated when, as in the instance of these returns, illusion imitates the form of the hardest and driest accuracy.

MR. DENNY LANE ON GAS AND ELECTRIC LIGHTING.

It is generally known that Mr. Denny Lane, of Cork, takes a very close interest in electric lighting as a science and also as a business, and never loses an opportunity for making himself acquainted with the latest developments of the electric light industry at home and abroad. Rightly enough, Mr. Lane does not pay any particular attention to rough-and-ready electric lighting, such as that which passes muster in the majority of American towns; but constantly watches over the attempts of electricians to deal with the more fastidious customers who are to be found in these islands and in the leading Continental states. Latterly he has been interested in the prospects of electric lighting and gas in Paris, and has written two letters on the subject for publication in the Journal, whereof the one that appears to-day is to be taken as the supplement to that of last week. Mr. Lane very properly draws attention not merely to the excessively high price at which electric lighting is alone to be obtainable in Paris, according to the programme of the Edison Company, but also to the significant fact that, even at the exorbitant rates which he names, consumers will only be able to obtain a service of incandescent lighting upon certain onerous conditions, which reproduce (albeit in exaggerated degree) those worst features of gas consumers' dues which Gas Companies everywhere are now ashamed of, and are bent upon giving up. The payment of high deposits without interest, payment for services, a compulsory minimum rental, a high meter-rent—all these are required not only by the Edison Company of Paris, but also in this country, wherever electricians propose to supply current by meter. The meter-rents are particularly heavy; nothing less than about 2s. per month being heard of anywhere. As for the minimum rental, this is a relic of barbarism that would not be endured in connection with anything but the newest triumph of science. It means that, whether the consumer uses the light much or little, the purveyors will make sure of their own revenue. As Mr. Lane very pertinently observes, electricians who carry on their business under such a system will not cause great inconvenience to their rivals in the field of lighting. This is also proved by what we have to say elsewhere concerning the course of the electric lighting business in the United States. Electric lighting is essentially a fancy trade; and where it is introduced, the few who care to pay the fancy price demanded for it are soon found and satisfied. It has few or none of the elements of a popular or developing business, and may exist side by side with a gas company selling their commodity at even a comparatively high price, without seriously affecting them. This is the most rational as well as satisfactory view to take of the so-called rivalry between gas and electric lighting. An electric light company that did one-tenth of the business of a gas company in the same district would regard itself as prosperous. It would soon attain its position; and thereafter the gas company would still do ten times as much trade, and would never feel the rivalry of the new-comer.

WATER GAS IN ENGLAND AND AMERICA.

Water Gas Companies are still the rage in London. Shares of the original Water Gas Syndicate last week touched 20 prem.; and although there was then a sharp depression consequent upon the execution of private orders to "unload" at this point, there was a subsequent recovery, due to the solicitude of those who are working the speculation to prevent a collapse until they shall have completed their own arrangements. Another subsidiary Company—the North British—was launched at the end of the week. Seven times the amount of capital required was applied for in the case of the Nottingham and Derby Company noticed in our last—a wonderful tribute to the skill of the financiers who have the matter in hand. Meanwhile, some additional interest is being shown in the progress of fuel gas engineering in the United States; a number of more or less novel projects of this order being brought forward almost every week. We have already made the observation that the water gas process which Mr. Samson Fox and his friends are working appears very similar to that introduced into the United States by Mr. Loomis, who, we believe, claims to be the first to make water and generator gas successfully out of caking coal. This he does by applying the air-blast to the cold end of the charge—for example, if the coal is added at the top of the generator, then he makes it burn downwards. In a report on this process, which has been regarded as verging on the mythical by other water gas engineers, Mr. James R. Smedberg acquaints the readers of *Light, Heat, and Power* with its capabilities. The report fixes the limits of theoretical possibility in respect of water and generator gas production at 110,250 cubic feet of the former, or 161,000 cubic feet of the latter, for a consumption of 2000 lbs. of anthracite, containing 87½ per cent. of pure carbon. The calorific value of the former is to that of the latter as 3 : 1. In the usual methods of water gas production, in all the generator gas produced by the process of "blowing up," the fuel in the cupola is lost; not more than 42 per cent. of the coal is utilized as gas. It is claimed that the Loomis process, by saving both kinds of gas and mixing them together, should result in the production of 139,500 cubic feet of the mixture per 2000 lbs. of anthracite consumed in the cupola. The calorific value of the mixture would be 180 heat-units per cubic foot. When bituminous coal is used in the cupola, the resultant mixture contains some of the ordinary constituents of coal gas—notably its peculiar odour, which is supposed to render the compound safe in distribution, by giving warning of leaks. Practically, Mr. Smedberg states that the Loomis generators make 130,000 cubic feet of mixed combustible gas per short ton of 2000 lbs. of bituminous coal, of an estimated calorific value of 350 units per cubic foot. It will be remembered that Mr. George Westinghouse has been working in the same direction, of the conversion of the whole of the carbon of coal into combustible gas of one kind or another in one and the same cupola; but it has been suspected that these attempts have not been practically successful. It is, of course, open for anybody to say that the last word has not been uttered by those who are working in fuel gas. If Mr. Loomis's process does all that is claimed for it, it must be a capital thing for some purposes; and we should like to see it tried somewhere on this side of the Atlantic, as a check upon Mr. Samson Fox's much advertised experiences in the same line.

GAS AFFAIRS IN DUBLIN.

It is rumoured that the forthcoming arbitration on the matters in dispute between the Corporation of Dublin and the Alliance and Dublin Consumers' Gas Company will be an affair of considerable magnitude. It has already been announced that Mr. A. Vernon Harcourt, one of the Metropolitan Gas Referees, has been appointed an Arbitrator by

the Corporation; and it is understood that arrangements are in a forward state for a commencement of proceedings when the old scores between the parties shall have been wiped off. It is scarcely necessary to remark that there has been for a long time past a state of perpetual petty conflict, most detrimental to the public service, between the Gas Company and the Corporation; and while it is possible that the pending arbitration will result in disclosing the means whereby this condition of affairs between the parties—who are, after all, mainly related as buyers and sellers of one of the necessaries of town life—may be removed for the future, we have but faint hopes for peace in regard to the Dublin gas supply while there remain so many open sources of personal difference between the men engaged on either side. The doctrine that an envoy from one friendly Power to another must be a *persona grata* is a piece of wisdom one would like to see more widely acted upon. Personal incompatibilities go for a very great deal in the worlds of commerce and industry, as well as in diplomacy, although the fact is not sufficiently recognized. Who does not know of the lawsuits, losses, and inconveniences endured by shareholders of, and passengers by certain railways, merely because the chairman of one company has a mortal feud with the chairman of another line? So it is with gas companies and gas-supplying corporations. All the machinery of joint-stock or statutory trading and of municipal government has not extinguished the human nature of the men who pull the strings and work the machines. We do not say it only with reference to the personality of the Dublin gas service and that portion of the Corporation with which it has to reckon; but it is a duty that gas directors and town councils owe to themselves and to the public that, when selecting officials for particular duties, they should keep clear of firebrands, irrepressibles, and irreconcileables. A wrong choice in such a matter acts like a piece of grit in an engine-bearing—creating friction, heat, and loss that can only be really cured by removal. *Verbum sap.* We will not say anything that may look like prejudging the case as between the Corporation of Dublin and the Gas Company; but we have no hesitation in declaring that the most outwardly satisfactory of settlements between parties in such close relationship will break down sooner or later unless the individuals charged with the conduct of affairs on each side are devoid of extraneous mutual resentments and suspicions. Another thing—if any man is habitually suspected of being a rogue, and treated as such, there is a great temptation for him to justify the suspicion. Too many local authorities regard gas companies as diabolically ingenious in the arts of deception, and constantly watch their actions, not in the spirit of honest, above-board criticism, but just as a detective dogs a known pickpocket temporarily at large. This policy leads to no good. Whatever in these observations may now apply to Dublin let us hope may be rendered inapplicable for the future by the birth of a new spirit under the auspices of the fresh settlement to which we believe that both sides, who are heartily weary of squabbling, look for signalizing the cessation of the irritating and purposeless hostilities that have too long prevented the Corporation and the Company from mutually doing their best for the city.

CARELESSNESS IN USING GAS FOR FUEL.

The question of fuel gas is attracting much attention from gas engineers in the United States; which is only reasonable, seeing the prominence that the use of natural gas for manufacturing and domestic purposes has attained in some of the principal States of the Union. The greater care that has of late been exercised by the Natural Gas Companies in the conduct of their business, has also tended to raise the hopes of fuel gas makers, who see the time approaching when their artificial may compete on more equal terms with the natural product. Strenuous efforts are being made in many places where natural gas has been almost given away, to introduce measures of economy in consumption; and not before they were needed. We learn from a Pittsburg newspaper that for upwards of a year past the officials of a local Natural Gas Company have been measuring the consumption, making tests of improved furnace appliances, and otherwise investigating the fuel waste in various mills on their books. From these investigations, figures have been deduced showing what a large proportion of the fuel consumed is wasted. In one large mill, care in handling gas had brought the consumption down to less than 22,000 cubic feet for making a ton of iron; and further improvements in apparatus reduced the consumption to under 16,000 cubic feet. The best result yet attained was the production of a ton of puddled iron for a consumption of 12,100 cubic feet of gas in an improved furnace. As compared with this, it is stated that sometimes upwards of 65,000 cubic feet of gas is consumed per ton of iron produced. This shows how unwarrantably the fuel has been wasted, because it is so cheap and convenient in use. In one small mill, 3 million cubic feet of gas were burnt between Saturday night and Monday morning for merely keeping the furnaces warm. Representatives of the Gas Companies report having visited glass-works where nothing was being done, yet the gas was burning at full pressure because "the watchman "forgot to turn it down." On the whole, it is computed that at least half the gas now consumed in the Pittsburg mills is wasted through ineffective appliances and bad management. Wherefore the Gas Companies reasonably enough say that if manufacturers desire to preserve their present advantages in the matter of cheap fuel, they must take measures for putting a stop to this reckless waste. It is the old story of the disadvantage of having things too cheap. Man is a wasteful animal; and, like the traditional Chinaman, will burn down his house to roast his pig, unless he can be awakened to a sense of the damage he inflicts upon himself by his shortsighted extravagance. The disadvantage in the case of coal gas has been all the other way. It has been so costly that people have been afraid to incur the inevitable expense of experiments, in the direction of using it for fuel, which must necessarily be imperfect at the first trial. We have looked upon the experiments with cheap fuel gases at home and abroad with interest on this account, in the expectation that from lavishness in the beginning would come frugality, and that the experience gained in the manipulation of a cheap gas might cause confidence in dealing with a better and more costly fuel. There appears to be some danger, however, that the cheap gas will be all lost before manufacturers shall have learnt how to use it properly. Already the advice given to burn natural gas rationally, has driven some factory owners to abandon it and return to coal. Workmen are more saving of coal because it gives more labour in handling; and they are easier led to save their employers' pocket if by so doing they can spare themselves some labour. The same principle works in connection with the domestic use of gas for cooking and warming. The wastefulness of servants is a greater hindrance to the extended use of gas for these purposes than the objections of householders to gas cooking. Education is the only real cure for this evil; but it is not to be wondered at if householders grumble at the cost of experiments on the stupidity and carelessness of their cooks.

Owing to the removal, by order of the Mayor of New York, of the overhead electric wires in that city, Madison and Union Squares and the immediate vicinity were in darkness on the night of the 16th ult.

The tender of Messrs. Willey and Co., of Exeter, has been accepted for the new gas-works at Buckley, Flintshire. The same firm has also obtained the contract for the new gas-works to be erected at Milford Haven.

The subscription list for the issue of £250,000 of 4 per cent. perpetual registered debenture stock in the Gas, Water, and General Investment Trust, Limited, to which reference was made in the last issue of the Journal, will close for town and country to-day (Tuesday).

The Nettleton Chemical Company have decided to put up one of the self-contained and continuous ammonia stills supplied by Mr. Henry Simon, of Manchester. The still is worked entirely by steam, and is capable of dealing with from 40 to 45 tons of ammoniacal liquor per diem.

At the Universal Cookery and Food Exhibition now being held in the Duke of Wellington's Riding School at Knightsbridge, Madame Alting-Mees, whose recently-issued little book on cookery was noticed in the Journal for the 16th ult., is an exhibitor; and last week some children to whom she had given gratuitous instruction made a very successful display in the children's cookery competition.

We regret to record the death, on the 29th ult., in his 71st year, of Mr. Paul Whitaker, who until recently was Manager of the Bowling Gas-Works, Mill Lane, Bradford, which were erected about 30 years ago for the supply of the dye-works, mills, and house property of the late Sir H. W. Ripley, Bart., whose Executors now own them. The late Mr. Whitaker was one of the few remaining workmen-managers; having at one time done his own stoking. He took charge of the Bowling works (which now turn out 35 million cubic feet of gas per annum) at the commencement; and he is succeeded by his foreman (Mr. J. Hargreaves). Mr. Whitaker was a member of The Gas Institute.

Water and Sanitary Affairs.

The case of the *Consett Water-Works Company v. Ritson*, which is reported elsewhere, has arrived at an unsatisfactory conclusion. The facts are entangled in a mass of legal technicalities, very entertaining to a lawyer, but scarcely calculated to enlighten the lay intellect. The Company have made a reservoir, and the defendant has carried out certain mining operations at the same spot, so as to let down the surface and render the reservoir useless. The Company have accordingly claimed £15,000 damages, and an injunction to restrain the defendant from doing further harm. In the Queen's Bench Division last January judgment was given in favour of the Company. But this was only obtained by an arrangement; the two Judges before whom the case was argued being divided in their opinions, and it being understood that the case would be carried to the Court of Appeal. This has been done, with the result that the Master of the Rolls and Lords Justices Lindley and Lopes have reversed the decision of the Court below. Judgment therefore goes against the Company. From the facts of the case, so far as they can be extricated from the legal tangle in which they are involved, it would seem that this unlucky issue might have been avoided. The Company in the first instance claimed too much. They thought themselves secure in constructing their reservoir; relying upon an assumed right to have their works supported from beneath. On the other hand, the defendant gave the Company notice, before he proceeded to carry his mining operations into dangerous proximity to the reservoir. It is to be regretted that no arrangements were then entered into whereby the Company could have retained their reservoir, compensating the defendant for so much of the coal as he was thereby prevented from utilizing. The public interest demanded that the reservoir should be maintained; and, on the other hand, the doctrine of private rights rendered it reasonable that the defendant should be paid for his coal. Instead of this, there has been a fight in the Law Courts, and the reservoir is wrecked. It seems to be admitted that at one time there was a right of support for the surface; but somehow the right has disappeared—gone no one knows whither. Evidently the Company thought they had purchased the right. But even then they might have admitted that it was subject to the exercise of compensation. The law of the case was peculiar, and no doubt the Company were misled. The facts go back to a period more than a hundred years ago, when the then Bishop of Durham had absolute possession of the land, as lord and owner of the manor, subject only to a right of common on the part of certain commoners. In 1773 there came an Enclosure Act, under which a portion of the land was allotted to one George Clavering, whose successor was John Clavering, from whom the Consett Water-Works Company purchased compulsorily the land on which they subsequently constructed their reservoir. In the Queen's Bench Division of the High Court, Mr. Justice Smith decided against the Company in these words: "My judgment is "that the Claverings had, and still have, the right to "support from the Bishops of Durham, and the plaintiffs have "not." Here, it seems to us, we have a sufficiently clear indication of the snare into which the Water Company fell. In the Court of Appeal last week, stress was laid by the Judges on the wording of the Enclosure Act of 1773, which appeared to reserve to the Bishop of Durham, his successors and assignees, the power to get at the coal, without giving any compensation for damage in letting down the surface. The language of the Act certainly seems very strong on this point, though the question arises as to what the commoners were to get for their rights if the land allotted to them was thus to be let down under their feet. No doubt the Master of the Rolls was right when he said that the Bishop of Durham in 1773 was "one of the most powerful landowners, "and one of the most powerful personages in England," Hence, perhaps, the rather remarkable phraseology to be found in the Enclosure Act. The "dead hand" of the Bishop lies heavy on the Consett Water Company.

In the revived controversy as to the expediency, or inexpediency, of supplying water by measure, neither party seems to get "any forrader." It is a topic upon which the "steam" is periodically "blown off" in our "Correspondence" columns, and to some extent "Positive," whose letter was published a fortnight ago, is justified in saying that everything that has been stated *pro* and *con.* has been already put forward —with this qualification, however, that the cost of establishing a general meter system has yet to be accurately ascertained. If a universal supply by meter should ever become an accomplished fact—and its accomplishment may, at any rate, be relegated to the distant courses of the future—it will certainly be found necessary to make a fixed minimum charge against each household to which water may be supplied. This necessity must be admitted by every practical reformer who attempts to take the matter in hand in the present day, even as it was admitted now more than twenty years ago by Mr. Edward Easton. The recommendation made by that gentleman to a Select Committee of the House of Commons, presided over by Mr. Ayrton, in 1867, was that there should be a sliding scale adapted to the class of house occupied by the consumer, and that each house should have a certain amount of water allotted to it. Thus, to a house with an estimated rental of £100 per annum Mr. Easton would allot 150 gallons a day; to a £200 house, 300 gallons a day; and so on, upwards and downwards—provided, however, that no house should have less, or pay for less, than 50 gallons a day. The Companies, it was suggested, should charge the same rate as under existing tariffs for this minimum quantity of water; the consumer paying also for any additional quantity which might pass through the meter. This suggestion Mr. Easton reviewed in a paper which he read at the conference on water supply held at the International Health Exhibition in 1884, and reported in our columns at the time. Dealing with the great question of expense, which he admitted would appear to be prohibitive, Mr. Easton thought that both consumer and supplier would soon be reconciled to the initial cost of the meters—the one because he would know he was buying by measure, and the other because all the water supplied was being paid for. This, we incline to think, was too sanguine a view of the general prospect. But doubtless the allowance of a minimum charge in respect of every house might go far to reconcile water purveyors to a change which, at present, they show no disposition to adopt. On the other hand, once admit the principle of that minimum charge, and to many persons the whole scheme of reformation would lose its attraction. Looked at from another point of view, it must be remembered that the prevention of waste is very much a question of fittings. When new water-works are being constructed, it is usual to allow for a supply of 30 gallons per head per day. This, of course, is a maximum estimate; and, in the general way, the quantity actually supplied ought to be considerably less, although in some well-known cases it has even been exceeded. London, New York, and Glasgow have been conspicuously wasteful; whereas at Norwich and Sheffield, something like half the maximum allowance above mentioned has been found sufficient for all requirements. In these matters, prevention is very much better and easier than cure; that is to say, far more satisfactory results can be obtained from an absolutely new service, accompanied by proper waste-preventing apparatus, than when it is necessary to graft a new constant-service system on an old district in which antiquated and wasteful fittings have long been in common use.

The Gas Supply at Panama.—A short time ago the city authorities and gas consumers in Panama had reason for dissatisfaction at the quality of the gas supplied to them by the Panama Gas Company. We learn, however, by an extract from the *Panama Star and Herald* for March 30 last, that there is now a manifest improvement in this respect; the light afforded by the gas leaving nothing to be desired. This satisfactory state of things has been brought about by the energy and determination of the new Manager (Mr. R. Jordan, formerly of Exeter), who only entered upon his duties on the 1st of March last.

The Cost of Water-Works for Small Towns.—At a recent meeting of the Civil and Mechanical Engineers' Society, Mr. R. E. Middleton read a paper on this subject, describing the works carried out for several very small places. In conclusion, he gave the comparative cost of the works enumerated per head of population, and the annual burden thrown on each unit of population in each case; allowing for the money being borrowed at the same price and returnable in the same time. This served to draw a distinction between gravitation and pumping supplies. In each instance he considered the cast-iron pipes and the valves would in all cases be worn out at the end of each period of 30 years, and would have to be replaced. He took coal at the same price for all; and made the life of the engines and boilers 30 years. The gravitation supplies cost at the rate of £1 6s. 11½d. per head of population; the annual charge per unit for 30 years being 2s. 1d., and after this period has elapsed 1s. 1½d. The average cost of the pumping system per head is £1 16s. 4½d., the yearly charge being for 30 years 3s. 3½d., and after that time 1s. 7d. The gravitation schemes thus compare favourably with those where pumping is employed. The annual charge is less by about 38 per cent. in the former case than in the latter for the first 30 years.

Essays, Commentaries, and Reviews.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 873.)

Another broken week (the third running); for on Wednesday, being the 1st of May, the House was shut, as usual. Business, however, was pretty well up to the average; and the general tendency was favourable, especially after the reopening. With cheap money, fine weather at home, and enhanced prospects of peace abroad (at all events for some time to come), prices may be fairly expected to go better rather than worse. The tone of the Gas market, however, has not been good on the whole. One or two of the Foreign undertakings have slightly advanced; but they are the exceptions. Prominently before the rest, Gaslight "A" has been weak. For the cause of this we must perhaps look chiefly to electrical agency; but something is attributable to the water-gas delusion. It is noticeable that just at present it is the great Metropolitan Company's stock which has been most adversely affected. It is, therefore, advisable to remind investors that no person or company (other than the three existing Companies) can supply gas in the Metropolis. So that, even assuming that water gas is all that is claimed for it, and that it is patentable, the existing Gas Companies alone could supply it to the Metropolis; and it is only natural to suppose that they would do so on terms advantageous to themselves. Water gas, therefore, so far as the Metropolitan Gas Companies are concerned, must be either an advantage or *nil*. The drop of Gaslight "A" in the week was 5¼. The secured issues also changed hands at moderate figures. In South Metropolitans, the "B" fell away 2 towards the end of the week. Nothing was done in Commercials, but one transaction in the debenture, which is being bought by those who ought to know. In Suburbans and Provincials, one or two transactions have taken place in the rarely-touched issues, Crystal Palace and Brentford preference. Among Foreigners, Imperial Continental is 1 point easier; and the closing mark—216¼—was the lowest of the week. Buenos Ayres is in good demand, in expectation of improved prospects, and has gained another ¼. Oriental and Bombay are each ¼ better. The Water Companies have received only moderate support; and the general tendency was towards lower prices. New River was put down 2; but nothing was done in it. Southwark ordinary, *per contra*, rose 1.

The daily operations were: Good average business in Gas on Monday; but all Gaslight issues were dull. The "A" fell 2. Buenos Ayres was very brisk, and rose ¼. South Metropolitans were steady and unchanged. Water was quite at moderate prices, and New River fell 2. Gas was rather less active on Tuesday. Gaslight "A" receded 1 more. Buenos Ayres and Continental Union, however, marked top prices. Water was very quiet. East London was rather flat; but Southwark ordinary rose 1. On Wednesday the House was closed. On Thursday there was further hostility to Gaslight "A," and a fresh fall of 1½ was quoted; but Oriental and Bombay gained ¼ each. Crystal Palace ordinary were done at 205; and the 7 per cents. at 146. Water was more active, and Chelsea, Lambeth, and West Middlesex were done at middle prices. There was only a moderate amount of business in Gas on Friday, and prices showed no improvement, though there was no further fall. Brentford preference was done at 123. Water was quiet and unchanged. On Saturday, Gas was dull. Business was mostly in Gaslight "A" and Imperial Continental, each of which receded 1. South Metropolitan "B" fell 2; and Gaslight 4 per cent. debentures, 1. Water was a shade firmer; but quotations remained unaltered.

ELECTRIC LIGHTING MEMORANDA.

CLOSE OF THE BOARD OF TRADE INQUIRY—AMERICAN GAS COMPANIES AND ELECTRIC LIGHTING—SUMMARY TREATMENT OF OVERHEAD WIRES IN NEW YORK—THE COST OF ELECTRIC LIGHTING IN FRANCE.

At last the protracted inquiry by Major Marindin into the schemes of the projectors of electric lighting for London has come to an end. There have been 18 sittings in all; and it was only what might have been expected when the Inspector announced at the close of the last day's proceedings that he would take time to prepare his report. As we have already remarked, the matter before the Inspector has been resolved first into a conflict between the large and small companies, and then into a sort of three-cornered duel between the alternating, direct, and storeage battery systems of distribution. The scientific examination of the projects was left by common consent to Mr. Moulton, Q.C., who more immediately represented the advocates of the last-named system. He told the Inspector, in the course of his summing-up speech, that "no single question in the matter of electric lighting had changed in any way since 1883." He declared that the direct supply system is almost beyond question the best for the consumer, because a direct-supply company have the strongest inducement for developing the district through which their mains run. It is their interest, in short, to concentrate their business, while the alternating system enables a company to run hither and thither, picking and choosing customers, appropriating a large area without properly serving it. Moreover, the alternating system cannot be utilized for motors, which the suppliers of direct currents look to as an important source of business. Altogether, Mr. Moulton argued that the "direct system of electric supply offered the highest potential competition in keeping up to their work companies in limited areas." Unfortunately, there was a weak point in Mr. Moulton's own case, inasmuch as the Company which he represented have not subscribed the money which they will need if they obtain their Order. Although this fact does not speak well for the Chelsea Company, it does not affect Mr. Moulton's criticism of other schemes, which was searching and severe. Of course, the Counsel for the different petitioners claimed in turn that their respective cases were the best; but it appears to a reader of the evidence and speeches that they were all much more successful in picking holes in each others' schemes than in justifying their own. It will be most interesting to see what the Board of Trade will make of all this.

As a counterblast to what has been recorded lately in this column respecting the growth of desire on the part of American gas companies to take electric lighting into their own hands, we may cite some remarks made by members of the Ohio Gaslight Association on the recent occasion of their fifth annual meeting. Mr. L. A. Strong, of Mansfield, Ohio, read a paper on the results of the adoption of electric lighting by his company. It appears that, as usual, all the strength was on the side of the gas company; the electric (arc) lighting concern before they took it up being a sickly affair. It was made a branch of the gas company's general business, apparently being supplied only for street lamps and to a few customers who asked for it. The rough-and-ready supply of a few arc lamps strung along the streets in this way is scarcely what one can fairly dignify as constituting a fusion of the electric lighting and gas interests. The President of the Association, Mr. Wood, of Syracuse, declared that his company were fully satisfied with their combination of arc, incandescent, and gas lighting; but all are not of the same opinion. Mr. James Somerville and others gave the other side of the question, and showed that all American gas managers are not yet carried away by the arguments that have lately converted General Hickenlooper, by testifying to the advantage of sticking to their own original trade. In Indianapolis, the gas lighting of which place is under Mr. Somerville's care, the people have the choice of electric lighting of both kinds, and there is also natural gas, water gas, fuel gas, and what not. If the coal-gas company had once begun to take in any one of these ventures as a department of their own business, they would not have known where to stop. Wisely, however, as we think, the gas company would have nothing to do with anything but their own concern. They are on good terms with the local electric light company, whom they allow to get a price for their lamps which permits them to make a good reasonable price for gas. They recognize that there is room for both; and if people like the idea of a little competition, they have it without injuring anybody. Several other speakers went on the same lines. Altogether, there does not appear to be much in the loudly-proclaimed conversion of American gas companies to the idea of providing electric lighting, at least in the Ohio district. The companies seem to do equally well with or without the new department. It should be noticed that all who have made the departure admit that the business is limited. The point of saturation of a town for electric lighting is speedily reached, after which there is little or no increase whether the light is supplied by the gas company or by independent persons. When exploited independently, it rarely attains such proportions as to interfere with the business of the gas company; and when the latter take over ventures of the kind, they do so more often out of consideration for the proprietors, the local authority, and the public than from any expectation of making much profit by it. There are probably "wheels within wheels" acting in most places where consolidations of the kind have been brought about.

There has been a good deal of obstruction on the part of the electric lighting companies of New York to the expressed determination of the city authorities to have the overhead lighting wires removed and substituted by cables laid in the underground conduits prepared for the purpose. The inquiry mentioned in this column last week regarding the occurrence of gas explosions in these conduits was doubtless originated by those who would do everything in their power to keep to the overhead system of electrical distribution. The Mayor of New York, who, in the administrative system of the States, possesses powers widely differing from those wielded by the chief magistrate of an English town, has repeatedly instructed the electricians to put their wires underground, and the failure of these orders to produce any effect has been made fun of by the local newspapers. At last, however, the bolt has fallen. The Mayor grew tired of seeing his monitions treated with contempt; and about the middle of last month gave peremptory orders to his myrmidons which resulted in the summary cutting of overhead wires supplying 429 arc lamps used for street lighting. This is a way they have in the States. Up to a certain point the governing democracy allows itself to be outraged, swindled, laughed at, and set at naught. Workmen may strike and mob together in despite of an executive confessedly feeble, because appointed on the understanding that the law is to be supported by the bulk of the populace. Trading corporations also carry selfishness to the extremest limits of its possible development as a fine art, to the detriment of the public right. But the limit of endurable outrage being reached, the American eagle screams; and there is a sudden end of the trouble. Now possibly the New York electricians wish they had listened to the Mayor a year ago, and buried their wires before they were slaughtered.

No progress is yet perceptible in respect of reducing the cost of electric lighting, which for all that electricians may pretend to the contrary is the principal reason for its slowness in expanding into a great industry. We learn that a concession for central-station lighting has just been granted by the municipality of Havre, in France, according to which the price of an arc lamp of full power from dusk to 12.30 a.m, is to be £11 per month. The price of a 10-candle incandescent lamp for the same time of lighting

is to be 6s. per month, to include renewal by the contractor when worn out. It does not appear who is to be the judge of this circumstance, which may well be a point upon which contractor and consumer will differ. Of course there is to be a tax paid to the municipality on the business, amounting to £4 per kilometre or fraction of a kilometre for mains laid in the streets, and a subsidy of 5 per cent. on the gross receipts. Under these conditions we do not look for much development of electric lighting in Havre.

THE BOARD OF TRADE RETURNS RELATING TO AUTHORIZED GAS UNDERTAKINGS.

We have on more that one occasion had reason to doubt whether there is any justification for the elaborate returns as to gas undertakings which are prepared and submitted every year to the Board of Trade; and our examination of the latest of the series has done nothing to remove, but rather much to confirm and substantiate, those doubts. Indeed, we think the Board of Trade should be called upon to justify the great trouble and expense of the production of these statistics. The particulars called for as to authorized gas undertakings are somewhat of an inquisitorial nature, which, presumably, will account for the fact that hitherto, and for the first five years of the publication of these returns, there were no columns relating to the revenue account of authorized gas undertakings "other than those of local authorities"—to use the official language—although full particulars of receipts, expenditure, charges for interest, &c., net profits and their disposal, were required and published, in reference to the local authorities. Public bodies having, as we all know, neither souls nor bodies, and being therefore susceptible of neither spiritual nor corporeal punishment, there seemed to be, in this arrangement, a sort of rough-and-ready adjustment on the part of the officials of the Board of Trade, attributable apparently to consideration for the gas companies, which was something to their credit. Whatever the cause, the effect has ceased to be. In the latest series of returns, the companies are at length "tarred with the same brush" as the local authorities, in so far as that they have been called upon to fill up, and have very fully and satisfactorily filled up, columns showing their receipts and expenditure, as well as the balance carried to profit and loss account.

The change is one of considerable importance. It greatly increases the labour cast upon the officials of the gas companies—an additional burden from which they would gladly be relieved, though not quite comparable to the traditional last straw. Further, it involves increased trouble, to say nothing of expense in the printing of the returns, both to printers and the Board of Trade officials. But this would matter little if the work were well and intelligently done, which we take leave to say it is not. Lastly, it involves very serious delays, as is evident from the particular returns under review, and commented upon in the Journal for the 15th of January last.

Were we called upon to formulate an indictment against these returns, numerous counts would present themselves for consideration. To be really valuable and instructive, their issue should be prompt; the particulars given should be complete; and, above all, they should be accurate and unimpeachable. On the contrary, the returns are open to animadversion in all three respects.

The returns are not complete. Apart from a few cases in which it appears that, although application has been made for particulars, no return has been made, there are not a few gas undertakings which one would have expected to find in the list, but which seem to have been totally ignored. As examples, we may refer to the Corporation gas undertakings at Doncaster and Tunstall, and the Local Board gas undertaking at Filey, among Local Authorities; as well as to the Companies at Alnwick, Bridlington, Bury St. Edmunds, Dorchester, Grays, Margate, Swindon, and Uttoxeter. The list might be extended; but those named are not quite unknown in the gas world. We may notice further that, in the returns for the past six years during which they have been issued, several gas undertakings have persistently made default to the order of the House of Commons, and the urgent appeals of the Board of Trade. An amusing instance of this retiring modesty and reluctance to have their financial affairs and conditions made publicly known, may be quoted from the latest "Return relating to Gas Undertakings other than those of Local Authorities," p. 45. The return relating to the Risca and Pontymister Gas Company is printed in italics as relating to the year ended Dec. 31st, 1884; and the Board of Trade officials have appended, in the column of "Remarks," a note to the effect that "the Company have failed to make a later return in compliance with the order of the House of Commons. In spite of repeated applications, the Company state that they do not wish to be included in the return, owing to their depressed financial condition." Further as to completeness, the returns make known that there are gas undertakings of which the officials are unable to give their consumption of coal, their make of gas, their sale of gas, or the length of their mains; or they cannot separate and apportion their capital and expenditure, in the case of joint gas and water undertakings. This is quite natural, and no more than was to be expected; but it is none the less a blemish, and renders those particular returns valueless for many purposes of analysis and comparison. The returns are in many instances inaccurate and unreliable. This is easily demonstrated by examples from those for 1887, now under notice. In many of them, the figures, as they appear, are entirely inconsistent and incoherent. The following are cases in point:—

North Camp and Farnborough District Gas Company.—The work done by this Company in the year is represented by the carbonization of 476 tons of coal and the sale of 3,484,100 cubic feet of gas to 76 consumers. The sale of gas would therefore, at the price named (5s. 8d. per 1000 cubic feet), be about £915; meter-rental about £38; and residuals, £143—total, £1056, or (say) at the outside, £1162, or 6s. 8d. per 1000 cubic feet of gas sold. The capital is returned at £9500 only; yet the receipts are given as £3335—more than double our liberal estimate—representing 19s. 1¾d. per 1000 cubic feet of gas sold (at 5s. 3d.). The total expenditure is set down as £3126; and the balance carried to the profit and loss account as £209. Thus every 1000 cubic feet of gas sold cost the Company 17s. 11¾d.

Walton-on-the-Naze Gas and Water Company.—In this case the figures given are stated to refer to gas only: Coal carbonized, 248 tons; gas sold, 718,000 cubic feet, equivalent to 2886 cubic feet per ton of coal carbonized. Total make of gas, 1,209,000 cubic feet, or 4856 feet per ton; percentage of loss, 40·61. Estimating the receipts from the figures given, they should be about £350. They are given as (estimated) £473 (or one-third more), while the expenditure is £474; showing a loss of £1. Thus, every 1000 cubic feet of gas sold cost the Company 13s. 2·44d., and brought them in 13s. 2·11d. We learn from the column of "Remarks" that this Company is now absorbed in the Tendring Hundred Water-Works Company. On the face of the above statement, it was about time something happened to it.

Connah's Quay Gas and Water Company.—In this case we learn from the column of "Remarks" that the capital is for gas and water combined. It amounts to £65 per ton of coal carbonized, or £11 9s. 7½d. per 1000 cubic feet of gas sold. The work done is represented by the carbonization of 125 tons of coal, and the sale to 73 customers, of 709,000 cubic feet of gas (*i.e.* 5672 cubic feet per ton). The price charged for gas was 6s. 8d., with a discount of 10 per cent.; and for meters, 4s. Thus the receipts might be fairly estimated from these figures at £266. They are given as £524, nearly double this amount; and the expenditure as £327, with a balance of £197. Hence every 1000 cubic feet of gas sold (at 6s. net) realized 14s. 9¾d., cost 9s. 2¾d., and left a profit of 5s. 6¾d.

Romford Gas Company.—In this case the working details and results are good, but the financial results anomalous. Coal carbonized during the year, 2315 tons; gas made, 23,194,000 cubic feet, or 10,019 cubic feet per ton; gas sold, 21,003,700 cubic feet, or 9073 cubic feet per ton, being 90·56 per cent. of the make, and leaving 9·44 per cent. for gas used and not accounted for. The charges were: For gas, 4s. 2d. and 4s. 6d.; public lamps (168), 65s. 3d. and 90s. for 9 and 12 months respectively; meters, 5s. to 10s.; with 483 consumers. From these details a very moderate estimate of the receipts would fix them at about £5000. We are startled to find them given as only £2700 for the year; expenditure, £1707; and balance, £993.* Thus every cubic foot of gas sold at 4s. 2d. and 4s. 6d. (with public lamps as above), brought in only 2s. 6¾d., cost 1s. 7½d, and left a profit of 11¾d., equivalent to 4·63 per cent. upon total share and loan capital raised. Nevertheless the shareholders received full statutory dividends of 10 and 7 per cent., after payment of 5 per cent. interest on a loan capital of £4450.

These last three cases all appear on one page. The next examples partake of the ludicrous. The Bexhill Gas and Water Company carbonized 34 tons of coal during the year, and sold 131,300 cubic feet of gas, or 3862 cubic feet per ton; the proportion of loss on make being 38·33 per cent. The (combined) capital was £7823, representing £230 per ton of coal carbonized, or £59 12s. per 1000 cubic feet of gas sold. The receipts were £5, or 9¾d. per 1000 cubic feet of gas sold; and the expenditure, £69, or 10s. 6¾d. per 1000 cubic feet of gas sold—showing a loss of £64, or 9s. 9d. per 1000 cubic feet of gas sold. The Tyldesley-with-Shakerley Local Board are represented as having made 2,420,900, and sold 19,728,900 cubic feet of gas, or 814·91 per cent., upon the make; while, at East Dereham, the Local Board content themselves with selling 16,922,650 cubic feet of gas, or 184·39 per cent. upon a make of only 9,180,440 cubic feet of gas. The Whitby Gas Company, however, take the palm with a sale of 817·77 per cent. (29,650,000 cubic feet) upon a make of 3,625,700 cubic feet of gas. At Sunbury, on the other hand, the Gas Company, more modest, limit their demand upon our credulity to the sale of 9,895,800 cubic feet on a make of 9,490,900 cubic feet of gas, or only a trifle over 104·27 per cent.

Here we stop—not for want of material—in our quotations of what are, on the face of them, absurdities contained in the Board of Trade Returns relating to Gas Undertakings, as to which no explanations are vouchsafed. We do not say there is no explanation, nor should we be at any loss to suggest a simple and rational one in the more outrageous instances cited. In fact, for the purposes of our own investigation, we have made needful and obvious corrections—say, of printers' errors, or we have eliminated those which are vitiated by inherent defects, such as short period of

* With regard to the particulars furnished by this Company, it should be stated that we have received a letter from the Assistant-Secretary of the Board of Trade (Mr. Courtenay Boyle), accompanied by a copy of one addressed to him by the Secretary of the Company, in explanation of the figures, which, by inadvertence, were given for the *second half* only of the year 1887, instead of the entire year. The following are the correct figures:—Receipts, £5406 18s. 11d.; expenditure, £3422 12s. 4¾d.; balance, £1984 6s. 6¼d. Of course, the other peculiarities in the returns, to which attention is called in this article, may be capable of explanation. This does not, however, invalidate our argument, that these elaborate particulars are not justified by public requirements.—Ed. J. G. L.

working, or non-collection of gas-rental. It would, possibly, be too much to expect that there is any one official at the Board of Trade qualified to look through the returns with the intelligent eye of an expert, having *connaissance de cause;* but surely there should be some one competent at least to correct revises for the press, and look over—not overlook—an advance copy to see that corrections have been duly made.

Under the third count of the indictment, we have but little to add to our former strictures. It must be obvious to the meanest capacity that returns of working for the year 1887, and up to (say) Lady-day, 1888, in cases where the annual accounts are made up to that date, should be published not later than Michaelmas, if they are to be opportune and really valuable. To issue them in January, 1889, and more especially when many of the figures relate to 1886-7 (down to June 30 in the latter), is to relegate them to the domain of ancient history. They come before us with a musty flavour, as of an old monkish chronicle, or of a mummy from the Valley of the Nile. Whereas gas engineers and managers of the present day are not, as a rule, Dryasdusts. For all these reasons, then, we are moved to inquire, and to doubt, whether the Board of Trade can show adequate justification for their procedure.

If any further demonstration were needed of the merely perfunctory and quite inefficient way in which the duties of the Board's officials, charged with the compilation of these returns, are performed, it would be found in the extract from the *Board of Trade Journal* (Vol. VI., No. 30, p. 76), which we gave on the 29th of January last. Article XI., "Authorized Gas Undertakings," contained the table showing the totals of the Local Authorities and Companies' returns, supplemented by certain particulars relating thereto, taken from "a memorandum which has been prepared upon the subject by the Railway Department of the Board of Trade"—particulars of which we then quoted, without comment, for the information of our readers. The chief features of that extract were some comparisons between the Companies' and Local Authorities' returns; and this is, perhaps, the point of view of the greatest interest; as to which, indeed, whether early or late in their publication, they merit consideration, with the condition precedent that all sources of error should be vigilantly sought out and guarded against.

This simple precaution, however, would seem to have been deemed superfluous by the representative official of the Railway Department of the Board of Trade who undertook the computations. As a matter of course, we have for our own information examined the returns in detail, and obtained results which, on collation with the table referred to, are found to differ therefrom in many items—though not in all very widely, yet sufficient to show the inexactitude of the official figures. The computer went sufficiently deep into the matter to see that out of the gross total of 386 Companies he must deduct two cases of no returns; but he failed to see the necessity of securing accuracy by striking out the capital, authorized and raised, of Companies which, not being yet at work, contributed no quota to the returns of coal carbonized, gas made and sold, length of mains, number of consumers and public lamps; or which, being at work, omitted one or another of those essential columns. But the most singular oversight committed by him is in the number of Local Authorities who failed to make a profit on their undertakings—viz., 41, as compared with 5 Companies in similar evil plight. The latter number is quite correct, as to the Companies on which the expenditure exceeded their income; so that the *gross* profit that might have been is converted into a loss. The number of Local Authorities is also correct, as representing those which showed a loss in lieu of a gain in the column of *net* profits; but that is a very different matter, and the two conditions are not comparable. The fact is that, in the Local Authorities' returns, there is no column of gross profits corresponding to the difference between receipts and expenditure, or balance carried to profit and loss by the Companies. This information is replaced by two other columns of figures, showing the further charges (such as interest on loans, redemption of annuities, repayments of loans, and sinking fund appropriations), and the amount of net profit, if any, after payment of such items. Not even the proverbial "meanest capacity," outside the sphere of routine and red-tape, could fail to grasp the distinction, and to see that the gross profits were easily ascertainable by deducting expenditure from receipts, or adding net profit to charges for interest, &c. As a matter of fact, there were but 4, and not 41, Local Authorities that, "failed to make a profit" in the sense applied to the Companies.

On the whole, out of 22 results, we find agreement with only 6 of the Government computations, and a difference in the remaining 16—slight in some, but material in others. We reserve the particulars of our own analysis for another article.

A SEASONABLE STUDY—PAINTS.

To describe the present season as an example of "Winter lingering in the lap of Spring" would not have an appearance of novelty to an English reader, seeing that for some years past the denizens of these islands have resigned themselves perforce to the loss of what seems at one time to have been the most charming period of the year. Fogs and frost in April and May, heavy downpours of rain and hail alternating with bitter north-easters, do not give us moderns the same appreciation of Spring as our forefathers appear to have had. To us the phrase "Spring had set in with its accustomed severity," is nearer the truth than the rapturous descriptions of the same season which we read in the old English poets. It almost appears that the forcing process whereby the period of youth and immaturity has been abbreviated in many modern instances has extended to the years, and that Spring is hurried over, not to make more room for Summer, but to allow the artificial mist and gloom which exaggerate our winters to work out their full developments. Whether winds breathe soft or biting, however, Spring never fails to bring one sign of its presence besides lengthening days, and that is—the painter. What becomes of painters in the winter is a problem upon which other varieties of the British workman are wont to exercise a rough-and-ready wit; but it is certain that, whereas town residents learn through correspondence in the newspapers that those traditional harbingers of Spring, the swallows and the cuckoo, have been seen and heard in country places, they might retaliate upon country cousins by naming as urban spring visitants the cheerful painter and his associate the whitewasher. Not only do town residences confess the presence of these busy visitors, making life so intensely wretched for anybody else who cannot get out of their way; but also in the grimiest factories painters are manufactured out of "handy men," and set to touch up iron and wood work stained and worn by the long winter's wear. The modern extension of the use of wrought iron and steel in place of the less perishable cast iron, has rendered the regular use of the paint brush imperative in places where it was formerly seldom seen. In gas-works particularly, there is now much more wrought iron and steel than could have been found a generation earlier, and the consumption of paint has accordingly largely increased. The manufacture of paints for iron work is a very much more important industry than it used to be; but it is to be feared that in many cases increased excellence of the product has not accompanied the swelling of the trade. Of course it may be said, and with a great deal of truth, that the advance of knowledge in the matter of paint making has in some respects led to many improvements in the character of paints in general, and especially in regard to the preparation of paints for special purposes. Paints can now be bought that will cover and stand and preserve their colours when applied to purposes for which a few years ago painting was regarded as an unavailable means of protection. All the same, there is much truth in the reproach that when the application of chemistry to manufactures facilitated adulteration, it was in the paint, varnish, and oil trades that scientific sophistication found its favourite home.

Consideration of paints and painting is, as we have already said, seasonable just now; but it is also suggested by a recent paper of Professor V. B. Lewes, F.C.S., &c., read before the Institution of Naval Architects at their last meeting. The corrosion of iron ships is a subject which, regarded in its narrowest aspect, would not appear to specially interest gas engineers. Looking at ships as structures built of iron and steel, however, and only differing from other structures in the same materials by the severity of the corroding influences and strains to which they are exposed, it becomes clear that all who are interested in the preservation of these materials from the destroying influences to which they are naturally liable, must be able to draw valuable instruction from the experience of those who have to deal with these influences when manifested in their extremest rigour. Iron is perishable everywhere and under all ordinary conditions of use; but what will preserve the ironwork of a ship would, as one may reasonably conclude, preserve ironwork anywhere. It is this thought that impels us to devote some attention in these columns to Mr. Lewes's interesting paper.

The author does not set out with any claim to having made or heard of any new or startling discoveries in connection with his subject; but merely desires to keep the matter before the world of technical workers in iron and steel, in order that the ever-present importance of this particular quality of iron structures—perishability—should not be lost sight of. Professor Lewes has already done good service by pointing out in a paper read two years ago that in all processes of rusting, carbonic acid gas and moisture play an important part, the iron uniting with the carbonic acid and oxygen of the water to form ferrous carbonate, whilst the hydrogen is set free; the ferrous carbonate then taking up oxygen dissolved in the water, or present in the atmosphere, as the case may be, and decomposing into ferric oxide (rust) and carbonic acid, which being liberated in actual contact with the moist surface of the iron carries on the process of "rusting." This view of the phenomena is confirmed by a paper read by Professor Crum-Brown before the Iron and Steel Institute in Edinburgh last autumn, and is generally accepted as the true explanation of the corrosion taking place on iron or steel surfaces exposed to moist air or fresh water. The action of salt water on iron has been supposed by some chemists to involve a more complicated reaction; but Professor Lewes is persuaded that this is mythical, and that there is no essential difference between the rusting of iron in salt water and in fresh. Salt water, however, may, and probably does, set up a galvanic action between iron and any foreign substances in contact with it; but with this part of the question we are not particularly concerned. Any place where wet coal or carbon dust is brought in contact with iron, which is specially the case in gas-works, is held by Professor Lewes to show speedy corrosion of the metal.

Dismissing metallic coatings of ironwork as unsatisfactory, Professor Lewes enumerates five divisions of non-metallic preservative coatings in common use. These consist of oil paints; pitch, asphalt, tar, or waxes; varnishes consisting of resins and gums dissolved in volatile solvents; varnishes containing substances to

give them body; and coatings of cement. Before going into these in detail, he gave some necessary consideration to the condition of the surfaces to which they have to be applied. When an iron structure is scraped down to the bare metal, there is presented a huge surface which varies in temperature much more rapidly than the surrounding air. As it cools, so the iron chills the layer of air in immediate contact with it, and shows, by what is called "sweating," the deposition of surplus water on its surface, over which the protective coating has to be applied. If now a rapidly drying varnish is put on, the evaporation of the volatile solvent causes again a further loss of temperature, which brings another deposition of condensed moisture, this time on the surface of the protective, so that the coating is sandwiched between two layers of moisture, both of them probably acting deleteriously upon the resin or gum of the varnish, whilst the moisture on the iron also prevents adherence of the varnish to the metal. If instead of a quick-drying varnish a paint had been used, the second deposition would not have taken place; but the sweating of the iron would have prevented cohesion, and when dry any rubbing of the coating would bring it off in strips. The condition of the skin of an iron structure while the coating intended to protect it is being applied, is one of the prime factors in the observed discrepancies in the behaviour of such compositions. Too much stress cannot be laid upon the condition of the surface of the iron at the time of coating; and it is perfectly essential either to have a dry surface or else a composition which is not affected by water. The author remarks that when an old iron structure is broken up, on the backs of the plates may often be seen the numbers painted on them in white lead and linseed oil when the work was put together, and under the paint the iron in a perfect state of preservation, the secret being that the paint was put on while the plates were hot and dry.

Compounds prepared with boiled linseed oil are, however, open to objection, on account of the presence of lead. The drying of boiled linseed oil is due to the fact of its containing a certain quantity of an organic compound of lead; and the drying property is moreover imparted by boiling it with litharge (oxide of lead), so that lead compounds are present even when the oil is not mixed with red or white lead pigment. When boiled oil dries, it does so by absorbing oxygen from the air, and becomes converted into a kind of resin, the acid properties of which also have a bad effect upon iron. Protectives of the class of tar and its derivatives, such as pitch and black varnish, and also asphalt and mineral waxes, are regarded by Professor Lewes as among the best. Certain precautions, however, must be taken in the case of tar and tar products, both of which are liable to contain small quantities of acid and of ammonia salts. If care is taken to eliminate these, and if it could be contrived to always apply this class of protectives hot to warm iron, the question of protection would be practically solved; bituminous and asphaltic substances forming an enamel on the surface of iron which is free from the objections to be raised against all other protectives—that is, of being microscopically porous and therefore pervious to water. Spirit or naphtha varnishes are condemned by Professor Lewes as open to several objections. Varnishes to which a body has been given by some pigment, generally a metallic oxide, are preferable to the last class, "if the solvent used is not too rapid in its evaporation, and if care has been taken to select substances which do not themselves act injuriously upon iron, or upon the gums or resins which are to bind them together, and are also free from any impurities which could do so." At the present time, as the author truly remarks, the favourite substance for this purpose is the red oxide of iron; but care should be taken to exclude from it free sulphuric acid and soluble sulphates, which are common impurities and extremely injurious. The finest coloured oxides are, as a rule, the worst offenders in this respect, as they are made by heating green vitriol (sulphate of iron), and in most cases the whole of the sulphuric acid is not driven off, the heat required being injurious to the colour. The acid is often neutralized by washing the oxide with dilute soda solution; but very little trouble, as a rule, is taken to wash it free from the resulting sulphate of soda, which is left in the oxide. The best form of oxide of iron to use for paint making is obtained by calcining a good specimen of hæmatite iron ore at a high temperature. When prepared in this way, it contains no sulphates, but a proportion of clay which is harmless if it does not exceed 12 to 18 per cent. Paint makers can easily test their red oxide for soluble sulphates, by warming a little of it with pure water, filtering, and adding to the clear solution a few drops of pure hydrochloric acid and a little chloride of barium solution. If a white sediment forms in the solution, the sample should be at once rejected.

In the application of a preservative coating to iron, Professor Lewes directs, first, thorough scraping and scrubbing from all non-adherent old paint and rust. New iron should be pickled with dilute acid to get rid of every trace of mill scale; the acid to be neutralized afterwards by a slightly alkaline wash, and this again to be washed off by clean water. Under these conditions, and given a composition with good adhering properties, but little apprehension need be felt with regard to the ravages of corrosion; the chief remaining risks being from abrasion or other mechanical injury to the composition, coupled with improper constituents in itself. In conclusion, we have only to recognize the great care and knowledge with which Professor Lewes has prepared his paper, which has been reprinted, and may be profitably consulted in detail by all who are in any way interested in the subjects of ironwork and ironwork paints.

Notes.

A Natural-Gas Meter.

A recent issue of the *American Manufacturer* contains an illustrated description of the Westinghouse Natural-Gas Meter, designed to deal with the later conditions of the natural gas supply, when the companies can no longer afford to sell the product without measurement. No meter heretofore manufactured has been found suitable for this purpose; and the present apparatus, which is the joint invention of Mr. George Westinghouse, jun., and Mr. Chauncy N. Dutton, differs essentially from the ordinary kinds of meters made for measuring coal gas. It is described as being a universal fluid meter, capable of being adapted for measuring any fluid under any conditions. It is claimed to work successfully under any pressure from $\frac{1}{10}$-inch of water up to 1000 lbs. if necessary; the only limit being the strength of the cast-iron or steel case. Exteriorly it resembles in form a common diaphragm gas-governor, being made in the shape of a flattened hemispherical dome, with a cylindrical capsule on the top, through which is the outlet; the dial being on one side. The inlet is at the bottom. The internal measuring mechanism consists of an annular spherical sheet-metal drum, divided into six measuring compartments or chambers. The drum is placed horizontally instead of vertically, as with ordinary gas-meters; and the chambers open from below, being permanently sealed in a fluid unchangeable under all conditions. The fluid is introduced through a filling tube. Each compartment forms a fixed equalizing chamber, which makes the measurement uniform. The drum is fixed by means of its vertical axis in such a way that it cannot rotate; but the extremity of its vertical spindle is free to revolve round a circle. In other words, the drum has a librating, or as it might be familiarly termed a "wobbling" motion, like a boy's top when it has nearly finished its spin, although without the axial rotation. In the cover of the drum is a rotary valve—or slide valves may be substituted for this, according to the size and design of the meter—which controls or directs the flow of the gas to be measured. Attached to the valve seat is a frame containing a shaft-bearing and shaft coinciding with the axis of the drum, and loosely connected at one end with the valve. In the upper part of the case is another bearing and shaft coinciding with the axis of the case, and geared at one end to the register, so as to drive it. The adjacent ends of these shafts are joined by a link, which can be adjusted in length to vary the angle between the axes of the case and the drum, whereby the adjustment of the meter for accuracy may be made. Gas enters the meter centrally through the lower shell, the inlet extending upward into the central division of the drum, above the sealing fluid. The valve, according to its position, directs the flow of gas into two or three adjacent measuring compartments of the drum, filling them, measuring the quantity of gas, driving the mechanism, and simultaneously discharging gas already measured from the opposite compartments. The force utilized is that of the flow of gas, which tends to lift out of the sealing fluid that side of the drum to which the filling compartments belong, and by the same action depressing the drum and emptying the contents of the opposite chambers. The link joining the two shafts, by holding the axes of the drum and case always at a fixed angle, converts this simple vacillating movement into a librating motion, rotating the two shafts and driving the index train and the valve, which latter simultaneously admits the gas into, and allows it to exhaust from, opposite measuring chambers continuously. The meters are always run for 48 hours in the factory, under conditions similar to those prevailing where they are required to be used, and are then tested by the Government examiner.

The Archer Oil-Gas Process.

The particulars of another oil-gas process, the invention of a Mr. Archer, and distinguished by his name, are given by the *American Manufacturer*. It differs from others in the use of superheated steam to vapourize the oil; the superheating being effected by a fire of coal slack. It is claimed to be very successful in practical working. The apparatus is all contained in a rectangular brick bench, or setting, and comprises superheaters, mixers, and thermogen, standing in a space 6 ft. 6 in. square by 8 ft. 6 in. high. The lower part of the furnace is circular, about 4 feet clear from a height of 4 feet, until the fire grate is reached, where the brickwork is stepped inwards for supporting a cast-iron coil. The remainder or upper part of the setting is 5 feet square, and is covered with fire tiles. Upon the fire grate rests what is called a stool, 18 inches high, which carries the thermogen, a vertical steel cylinder 56 inches high and 18¾ inches diameter. This cylinder is divided transversely into four sections by perforated plates, intended to effect the thorough mixing of the gas as it passes through them. The thermogen is surrounded at a little distance by a cast-iron double cylinder, in the walls of which is placed a coil of 1½ in. pipe, cast solid in the thickness of the iron. Between the inner side of the cylinder and the thermogen is another coil of pipe for superheating the steam. Mixing pipes 4 in. diameter, and more superheaters, are located in the side flues of the setting. The heat of the fire which burns on the grate already mentioned rises round the thermogen and its surrounding coils, passes up over the top of the cast cylinder, and is led through the flues containing the mixers. Steam

generated in a separate boiler is brought into the apparatus, passing first through the superheaters in the flues, then into the coil in the cast cylinder, and then into the mixers, where it meets the oil. The mixed vapours of oil and water then enter the bottom of the thermogen, and after rising through this part of the apparatus they are called gas. It is stated that one such apparatus will provide gaseous fuel for three 18 ft. by 6 ft. multitubular boilers, or supply two steel ingot heating furnaces having a capacity of 12 tons per heat. It is estimated that 16 gallons of crude oil will produce sufficient gas in this way to heat in 3½ hours a ton of steel ingots to a temperature fit for rolling. The cost of the gas is reckoned at about half that of coal gas, and less than one-third that of coal required to do the same work. The apparatus is intended to be built close to the boilers or furnaces to be supplied, in order to avoid loss by condensation. As the gas is used hot, it is therefore not measured.

THE CREATION OR DIFFUSION OF FOGS BY CONCUSSION.

A novel proposal for the dispersion of fogs has been made by a Swiss artillery officer, who has placed upon record his opinion that a phenomenon of this kind recently occurring under his observation was due to a discharge of some pieces of ordnance. This statement has been circulated in France, and has elicited communications upon the atmospheric effects of artillery fire, leading to quite a different conclusion. It has been stated, for instance, that during the siege of Belfort, in the Franco-Prussian war, where an average of 1000 discharges of cannon per hour was registered for many days in succession, firing was frequently suspended on both sides owing to the dense fogs which settled down upon the field of action. This observation would give ground for the supposition that concussions of the air near the surface of the soil, by interfering with the circulation of air, bring about that congested condition of the atmosphere which is a necessary condition for the production of fogs. This conclusion leads further to the idea that not only the aggregation of houses in towns, preventing the passage of light breezes, determines the production of fogs in such localities, but also that the concussion of air due to the shocks of town traffic may operate in the same way. Further observations are desirable in regard to this matter; but now that the nature and causes of town fogs are so carefully studied with a view to their prevention and cure, it is desirable that every contribution to the elucidation of the subject, however apparently insignificant, should receive its due meed of attention, because if not conclusive in itself it may possibly contain the hint of something that it would be misleading to overlook.

THE BATLEY WATER-WORKS ENGINEER.—In the JOURNAL last week the name of Mr. C. T. Hamer was given as the new Engineer and Manager of the Batley Corporation Water-Works. We find that the gentleman appointed was Mr. Oscar J. Kirby, who for the past eight years has been Assistant Manager of the Devonport Water Company. There were 111 applicants for the appointment, out of whom five were selected by the Water Committee as being specially qualified to fill it. After an interview with these candidates, their choice fell upon Mr. Kirby, who will enter upon his duties next month. Before going to Devonport, Mr. Kirby was in the service of the Sheffield Corporation.

THE LIGHTING OF THE PARIS EXHIBITION.—Writing last Tuesday, the Paris correspondent of *Industries* said: "The lighting arrangements in the gardens are incomplete; and in some cases the buildings which are to contain the electric lighting machinery are not yet finished. During the time of the exhibition, some of the boulevards are to be lighted by electricity; and the various underground conduits are well in hand. It is expected that the lighting will begin on the 1st of June; and the work is carried out by the following firms:—The Paris Edison Company, the Deprez-Rothschild Syndicate, and M. Popp. The contractors have undertaken to keep the lights running from the 1st of June to the 1st of December, after which the installations will be removed."

HEALTH CONGRESS AT HASTINGS.—Last Tuesday evening a Health Congress was opened in the Royal Concert Hall, Hastings, under the presidency of Dr. B. W. Richardson, who delivered an interesting Inaugural Address. In the course of the week instructive papers were read by the Presidents of the different sections and others; among them being one by Major-General Webber, C.B., on the "Lighting of Towns in relation to Health" (in which he advocated the use of electric light on sanitary grounds), and another by the Borough Surveyor of Hastings, Mr. P. H. Palmer, Assoc. M. Inst. C.E., dealing with the water supply of the town. In connection with the Congress, an exhibition of domestic and sanitary appliances is being held in a building specially erected for the purpose.

THE WATER GAS ENTERPRISE IN ENGLAND.—Last Saturday the prospectus of another offspring of the British Water Gas Syndicate appeared—viz., the North British Water Gas Syndicate, Limited—with a capital of £301,000, in shares of £5 each, to work in Scotland patents for manufacturing water gas. Two other Companies were registered last week—one in the name of the Scottish Water Gas Company, Limited, the other in the name of the Lancashire Water Gas Company, Limited. The Directors of the British Water Gas Syndicate, however, announce that they have nothing to do with these Companies. It is stated that the Yorkshire Water Gas Company, Limited, have sold the rights for the borough of Sheffield for the sum of £30,000; and that a similar offer is on hand for Leeds.

Communicated Article.

THE CHEMISTRY OF ILLUMINATING GAS.

By NORTON H. HUMPHRYS, Assoc. M. Inst. C.E., F.C.S.

XVII.

A paper on "Wilkinson's Process for the Manufacture of Illuminating Gas from Wood" was read at a meeting of the American Chemical Society by Dr. Doremus, in December, 1880,* and is now alluded to for the purpose of affording some information as to the quality and composition of gas obtained from that material. A special feature of the process consists in working at very high heats, so as to obtain a large quantity of gas, regardless of the quality, for the purpose of diluting rich naphtha gas. Dr. Wilkinson was the Chemist to the Mutual Gas Company, of New York; and the paper, in addition to a description of the process as indicated by the title, included an account of the method of manufacture followed by the Company. It appears that besides the wood gas a very poor coal gas is also manufactured, so that the mixture of coal and wood gas forms in effect a cheap fuel gas; and this is carburetted by admixture with naphtha vapours. In order to reduce the quantity of carbonic acid present in wood gas, and at the same time obtain a larger yield, the retort is so constructed that the gas given off is made to pass through the charcoal left by the carbonization of the previous charge, before reaching the ascension-pipe. The result is that the carbonic acid is converted into carbonic oxide. The gas as supplied by the Mutual Gas Company to their consumers is stated to consist of 21 volumes of wood gas, 37·4 volumes of poor coal gas, and 41·6 volumes of naphtha gas. For each 1000 cubic feet of the mixture, 4½ gallons of naphtha are used. In the following table, No. 1 is an analysis of the wood gas, which, prepared in this way, bears a great resemblance to water gas. No. 2 is the coal gas, of which a yield of 14,650 cubic feet per ton is said to be obtained. But an examination of the figures explains how this high yield is made up. More than 20 per cent. of the gas consists of carbonic acid, oxygen, and nitrogen. After deducting this, we have about 12,000 cubic feet of pure coal gas, which is about the quantity that might be expected. Evidently the aid of a powerful exhauster is to be credited with all gas obtained beyond 12,000 cubic feet per ton. Nos. 3 to 7 represent analyses of the commercial gas taken at different times.

	I.	II.	III.	IV.	V.	VI.	VII.
Hydrogen	44·10	30·50	56·75	9·65	9·32	12·75	7·53
Marsh gas	5·40	41·00		43·55	42·49	39·21	48·63
Illuminants	—	2·00	15·25	15·55	15·45	15·22	14·43
Carbonic oxide	33·75	6·00	11·25	8·63	7·64	12·33	6·70
Carbonic acid	10·50	3·00	1·00	1·48	2·16	0·89	2·86
Nitrogen	6·00	16·00	15·00	19·92	22·79	19·36	19·85
Oxygen	0·25	1·50	0·75	1·22	0·15	0·24	—
Ammonia	—	trace	—	—	—	—	—
Sulphuretted hydrogen	—	trace	—	—	—	trace	—
	100·00	100·00	100·00	100·00	100·00	100·00	100·00

Dr. Ellett and Dr. Torry, of New York, published the results of some experiments on wood as a gas-making material more than 30 years ago.† These are shown in the following table. No. 1 is the product obtained by distilling a charge of thoroughly dried pine wood in a retort described as a "cellular" retort, but of which no further particulars are given. Consumed in a specially constructed burner at the low pressure of 0·1 inch—circumstances that experience had proved to be most favourable for the development of its light-yielding powers—it was found to possess about three-fourths of the illuminating value of a high quality coal gas, prepared by mixing four parts of common with one of cannel gas. No. 2 was obtained from pine wood, working at a lower heat; and No. 3 was obtained from oak wood. The yield in the case of No. 1 was high; being about 10,750 cubic feet per ton of wood. In No. 2 the yield was much less—being 8650 cubic feet per ton; but it is said that the quality of the gas was not much better. Probably this sample was not so well dried as No. 1. It will be observed that the gas is free from carbonic acid in each case; and the authors state that a large quantity of lime was required to affect this result.

	I.	II.	III.	IV.	V.	VI.
Hydrogen	24·17	14·50	30·15	15·07	18·43	33·12
Marsh gas	20·25	25·91	23·05	11·06	9·45	26·89
Illuminants	7·25	9·00	7·50	6·91	7·70	7·46
Carbonic oxide	39·25	42·94	33·33	40·59	61·79	32·53
Carbonic acid	—	—	—	25·72	2·21	—
Nitrogen, and other impurities	9·08	7·65	5·97	0·65	0.42	—
	100·00	100·00	100·00	100·00	100·00	100·00

Nos. 4 and 5 in this table are extracted from "Ure's Dictionary of Arts and Manufactures." No. 4 is a sample of gas made on a manufacturing scale at Munich, before purification. The only impurity found in wood gas is carbonic acid, but that runs very high in quality. It is put at more than 25 per cent. in this analysis; and several other authorities agree in respect to this high figure. Carbonic acid is costly of removal; and therefore must be a great drawback to the use of wood for making gas. No. 5 is a sample of wood gas as supplied in Bayreuth, taken after purification. The gas is said to be of better quality than ordinary coal gas, as might be expected from its composition.

* See JOURNAL, Vol. XXXVIII., p. 225. † *Ibid.*, Vol. V., p. 550.

The analysis marked No. 6 is extracted from an account of the "Walker" process for manufacturing gas from sawdust.* The gas is said to have an illuminating value of 15 candles; and a specific gravity of about 0·600. In the "Walker" process, the material is carbonized in a sort of screw retort, in very thin layers; and to this, as well as to complete drying, may be ascribed the superior nature of the gas, instanced by the large proportion of hydrogen and marsh gas, and the lower percentage of carbonic oxide present in it, as compared with other samples of wood gas. The sawdust is thoroughly dried before use, which is rather a costly affair, as, if made from logs taken out of the water immediately before cutting, it may contain as much as 50 per cent. of water. The analysis above given is said to be obtained from "ordinary" pine sawdust. Yellow pine or other resinous woods yield a higher illuminating power; but about the same quantity—from 12,000 to 15,000 cubic feet per ton of dry sawdust. No doubt the complete drying of the sawdust is a great help, as reducing the yield not only of carbonic oxide, but also of carbonic acid. It will be observed that other operators in this direction have been aware of the importance of well drying the wood before use; but perhaps sawdust admits of more complete drying than solid blocks of wood.

The composition of "air gas" is simply air *plus* a certain portion of vapour of carburetting material—such as light petroleum spirit, or naphtha. The fluid usually applied for the carburation of air consists of petroleum spirit, or benzol from shale or tar, having a specific gravity of ·650 to ·670. Mr. Wills has shown† that the *maximum* quantity of this vapour which air is capable of retaining varies with the temperature, and may be represented by the following figures:—

Temperature.		Percentage.	Temperature.		Percentage.
14° Fahr.	..	5·7	60° Fahr.	..	22·0
32° „	..	10·7	68° „	..	27·0
50° „	..	17·5	104° „	..	39·0

The air must be carburetted at the lowest possible temperature to which it is likely to be subsequently exposed, in order to avoid a partial deposition of the fluid. For example, if the air was passed through the carburetting material at a temperature of 68°, it would take up 27 per cent. of the same; but if subsequently exposed to a temperature of 32°, only 10·7 per cent. of the hydrocarbon would be retained—the remaining 16·3 per cent. being deposited in its original form. A scheme for producing air gas was exhibited at the Crystal Palace in 1873,‡ and it was stated that one gallon of light petroleum spirit would suffice for the preparation of 800 cubic feet of high-quality gas (30-candle power) leaving a little residuum, consisting of the heaviest part of the fluid. Mr. Collinge, who was Chemist to the project just mentioned, in referring to the same scheme, tells a rather different tale.§ He says that 1000 cubic feet of air will take up as much as 9 gallons of the spirit, producing a 40-candle gas; 1000 cubic feet of air, charged with 4 gallons of spirit, constitute a 16-candle gas. Perhaps this remarkable difference is to be ascribed to the omission of the "residue" in the first case; only the quantity of spirit actually taken up being stated. Since the manufacture of this so-called gas involves no chemical change, the composition of the product is easily estimated if the composition of the fluid is known.

Mr. W. Lyon succeeded in charging air with as much as 16 gallons of gasoline (specific gravity ·655) per 1000 cubic feet, yielding 1320 cubic feet of air gas, having a specific gravity of 1·396 (air = 1000), and an illuminating value of 23·7 candles.‖ This was the result of a laboratory experiment only. Mr. Denny Lane subsequently pointed out that the specific gravity in this experiment was probably much too low, as the quantity of gas stated would weigh some 40 lbs. less than the combined weight of the air and gasoline of which it was composed.**

Having noticed the composition of various kinds of illuminating gas, it will be well before entering into practical details respecting them, to direct attention to such of the properties of the principal constituents as have any direct bearing upon the subject.

On the occasion of the recent visit of the Duke and Duchess of Sutherland to America, they were entertained at dinner at Delmonico's, New York, by Mr. George Shepard Page, on the evening of the 15th ult. Covers were laid for twelve; and the dinner was worthy of this world-renowned establishment. Upon one of the walls of the room the head of a large carribou, shot by Mr. Page, was hung; and about it were grouped fishing-rods, fishing-baskets, gaff-hooks, reels, and other symbols of the angler's art. The engravings ordinarily hanging in the room were removed, and in their place were paintings of fish and game. In the centre of the table stood a large aquarium containing more than a dozen brook trout. The aquarium was surrounded by rare orchids; and all the space upon the table not actually needed for the service was covered with these flowers. Azaleas were arranged about the table in profusion, and drooped over the table in such a way as to form a complete arbour, covering both diners and dinner. The lower part of the walls was hidden in palms, banked with cut flowers. After dinner Mr. Page presented a salmon-rod to the Duke and a split bamboo rod to the Duchess, giving her another to be taken to England for Lady Alexandra Leveson-Gower.

* See Journal, Vol. LXIV., p. 460.
‡ *Ibid.*, Vol. XXII., p. 212.
‖ *Ibid.*, Vol. XXXIII., p. 646.
† *Ibid.*, Vol. XXII. p. 511.
§ *Ibid.*, Vol. XXX., p. 918.
** *Ibid.*, p. 903.

Technical Record.

ON FLAME.

By F. J. Rowan, of Glasgow.

(*Concluded from p.* 763.)

Luminosity of Flames.—According to the commonly received theory of the causes of luminosity in flames (first propounded by Sir H. Davy*), the presence of solid particles suspended in the flame (or in immediate contact with the burning gas) is essential to its luminosity.

There is no doubt that the introduction of solid particles in a fine state of division into a flame of feeble luminosity, will impart to it a considerable degree of brilliancy by the incandescence of the solid particles, or perhaps in some cases by reflection of the light from their many surfaces. No sound conclusion, however, as to the luminosity of flames in general can be drawn from such an analogy as is afforded by the result of such an experiment, because Tyndall has shown that the same result is produced when the solid introduced is one that does not burn. The presence of solid particles, according to the common idea, in luminous flames is only assumed, not proved. It is usual, however, to refer to the black deposit which is formed upon a glass rod or similar body, when it is held in the flame of a candle or of hydrocarbon gas, as a proof that such flames contain solid particles. This, however, is not conclusive proof, for Dr. Frankland† has pointed out that this deposit is not pure carbon, but is a hydrocarbon compound. To this Dr. Percy‡ objects that it is fixed, not volatile, whatever its composition may be. But the objection seems to be irrelevant, because it refers to the substance as deposited; and we do not know that such a substance existed in the flame. The introduction of the cold surface of the glass rod not only condenses some vaporous hydrocarbon, but doubtless also causes decomposition of some of the many hydrocarbons which make their appearance in the gradual resolution of carbonaceous matter. As, therefore, we do not know in what combination this substance producing the black deposit existed while it was originally in the burning gas, it cannot properly be asserted that it was "fixed, not volatile."

The phenomena of many luminous flames are explained by various writers, with more or less ingenuity, on the hypothesis of solid particles, but the experiments and observations of Dr. Frankland§ have shown that that hypothesis is not wholly satisfactory, because luminous effects have been produced where it could not account for them, such, for example, as the luminosity of the flame of hydrogen burning in oxygen under pressure; and, secondly, because in many of the brightest flames the temperature is such that fuliginous matter‖ could not exist in them. In many cases, it might seem, therefore, to be a more satisfactory explanation, that the luminosity of flames depends on the existence of a comparatively high temperature, and on the presence of gases or vapours of considerable density.**

Soret†† made, in 1874, some experiments which were intended to refute the opinion previously given by Hirn adverse to Davy's theory of solid particles. These experiments consisted in projecting, by means of lenses, the image of the sun on to the surface of several hydrocarbon flames, and examining the degree of polarization of the reflected light by the use of a Nicol prism. As the light was observed by the eye, it was necessary to interpose several plates of cobalt-coloured glass, and the sunlight was distinguishable from the light of the flame merely by means of a trace of blue which was ascribed to it as distinct from the purple colour yielded by the flame light.

Soret obtained similar results, though in varying degree, with sunlight when reflected from lampblack, from non-incandescent smoke, from smoky carbon flames, and from the flames of candles and hydrocarbon gas having different degrees of carbonation. When, however, the flame, even of highly-carburetted gas, burned in an atmosphere of abundant oxygen, the blue trace and the polarization effect were invisible. In fact, his best results were obtained in proportion to the decrease of luminosity. On this account Soret was not warranted in concluding, as he did, that his results support Davy's theory, because they failed just when it was important that they should not fail—viz., when the luminosity of the flames was largely increased. If we accept these experiments as showing that sunlight was reflected from finely-divided particles in these flames, they also indicate that the luminosity of these flames was not only not due to the presence of these solid particles, but, on the contrary, that it was diminished by them as they disappeared from the brighter flame.

More recently Burch‡‡ has to some extent repeated Soret's experiments, making use, however, of the spectroscope in the examination of the light from the flame, and thus being better able to distinguish between it and the reflected sunlight. He found

* Phil. Trans. for 1817, p. 75.
† Proc. Roy. Soc. Lond., Vol. XVI., 1861; *Phil. Mag.*, Vol. XXXVI., 1868, pp. 309–311; "Experimental Researches;" "Lectures on Coal Gas."
‡ "Metallurgy," Vol. on "Fuel," p. 158.
§ *Op. cit.*, and *Jour. Chem. Soc. Lond.*, 1864, Vol. XVII., pp. 52–55; Brit. Assoc. Reports, Vol. XXXVIII., p. 37; Proc. Roy. Inst., Vol. V., 1869, pp. 419–423; Proc. Roy. Soc. Lond., Vol. XXX., No. 201.
‖ See Lectures on Coal Gas, delivered at the Royal Institution, London, March, 1867, by Dr. Frankland. Journal, Vol. XVI., pp. 184, 231, 325.
** *Jour. Soc. Chem.*, 1882, Vol. XV., p. 168; Watts's, "Dictionary of Chemistry," 1st Sup., p. 485.
†† *Phil. Mag.*, ser. 4, Vol. XLVII., p. 205; 1875, p. 50. Translated from *Archives des Sciences* of the *Bibliothèque Universelle*, 1873 and 1874.
‡‡ *Nature*, Vol. XXXI., p. 272.

that the reflected sunlight showed all the Fraunhofer lines, and that, on using the Nicol prism, it was polarized at right angles to the line of incidence; and he compared this result with that obtained from the reflection from finely-divided particles of shellac as precipitated by, and suspended in, water.

The observed effects being the same, he was perhaps justified in concluding that in the flames which he examined, the sunlight was reflected from finely-divided solid particles; although in the present state of this branch of the science of optics, it would be foolish to consider this matter proved. Finely-divided solid matter suspended in a viscous fluid, and rushing through a flame, represent very different physical conditions, and it is extremely improbable that we can safely reason from results afforded by one phenomenon to those of the other. The flame itself, by reason of the intense vibrations which constitute its existence, may behave towards sunlight in a manner very different from that of a transparent and almost quiescent liquid.

At any rate, Burch's results are far from proving that the luminosity of these flames was in any way dependent upon the presence of solid particles, except in so far (as Soret's experiments teach) as they may have acted in diminishing the degree of luminosity. The mere fact of the presence of solid particles, supposing that to be established, does not prove anything regarding any relation between them and luminosity. This is a distinct subject for proof.

On the other hand, the effect of high temperature is seen in the greater brightness of the flames of sulphur, phosphorus, and, indeed, all substances when burnt in pure oxygen, as compared with the result of their combustion in air. Direct evidence of the effect of high temperature is also afforded by the combustion of phosphorous in chlorine, for, whilst at ordinary temperatures only a feeble light is produced by this combustion (although the product PCl_3 has considerable density), strongly heated phosphorous vapour burns in hot chlorine with a dazzling white light.

A comparison of the relative densities of gases and vapours, shows that the brightest flames in general are those which contain the densest vapours.

Relative Densities of some Gases and Vapours.

Hydrogen	1
Water	9
Hydrochloric acid	18¼
Arsenious chloride	92½
Metallic arsenic	150
Arsenious oxide	198
Air	14·5
Oxygen	16
Carbon dioxide	22
Sulphur dioxide	32
Phosphoric oxide	71 or 142
Chlorine	35·5
Mercury	200

Hydrogen burning in chlorine produces a vapour more than twice as heavy as that resulting from its combustion in oxygen, and accordingly the light produced in the former case is stronger than in the latter. Carbon and sulphur burning in oxygen produce vapours of still greater density—viz., CO_2 and SO_2; and their combustion gives a still brighter light. Phosphorus, also, which has a dense vapour, and yields, in burning, a product of great vapour density, burns in oxygen with a brilliancy almost blinding.

The luminosity of a flame is increased by compressing around it the surrounding gaseous atmosphere, and it is diminished by rarefying it. Thus, mixtures of hydrogen and carbonic oxide with oxygen emit but little light when they are burnt or exploded in free air, but exhibit intense luminosity when exploded in closed vessels so as to prevent expansion of the gases at the moment of combustion.

Frankland experimented with jets of hydrogen and carbonic oxide burning in oxygen under a pressure which he gradually increased to 20 atmospheres, and obtained brilliant luminous effects, including bright and continuous spectra. Even the faint flame of alcohol, as in an ordinary spirit-lamp, becomes highly luminous under the receiver of a condensing pump, when the pressure of air is increased to 120 inches of mercury.

We are indebted to Frankland,* also, for the observation that the diminution in illuminating power is directly proportional to the diminution in pressure; and, as applied to ordinary domestic gas-burners, this means that, as the barometer falls, the light from them diminishes at the rate of 5·1 per cent. for every inch of fall. According to Dr. Letheby,† "in London the difference in the value of the light when the barometer is 31, as compared with what it is at 28, is fully 25 per cent."

The flame of arsenic burning in oxygen may also be rendered quite feeble by rarefying the oxygen; and, at high altitudes, flames exhibit the effects of rarefied air. Tyndall and Frankland‡ made observations on the combustion of stearine candles at the summit of Mount Blanc and at Chamouni, and found a considerable decrease in luminosity at the high elevation, although the rate of combustion of the candles remained the same in both places. The energy of combustion was therefore unaltered, although the flame in one case had a higher temperature than in the other, resulting from the increased density of the gaseous atmosphere. Percy shows ("Fuel," p. 159) that this conclusion should be drawn even from the theory propounded by Tyndall in explanation of the diminished luminosity which he observed on Mount Blanc. Tyndall's theory was that the decrease in luminosity was mainly due to the greater mobility of the air. From this Percy reasons: "Now, if increased mobility of the air be caused by rarefaction, the opposite should result from compression, in which case the movement of the particles would become sluggish, intermixture of the air and flame-producing gas would be less rapid, and the diffusion of the gaseous products of combustion in the surrounding air would be retarded, with consequent increase of temperature."

Frankland's conclusions have also been confirmed by some experiments by Professor V. Wartha* on the influence of pressure on flames.

At the Meeting of the Glasgow and Scottish Section of the Society of Chemical Industry on the 2nd ult. the foregoing paper, which had been presented at the previous meeting, gave rise to the following remarks:—

Mr. W. Foulis, Gas Engineer of the Glasgow Corporation, said he quite agreed with the author of the paper as to the importance of the subject, as the more knowledge we possess of the properties of flame, the more shall we be able to solve many of the problems relating to fuel consumption, furnace temperatures, utilization of gas for light, heat, and power, and many other questions of great importance in all kinds of manufactures. The paper had dealt with the subject from a theoretical point of view, and referred to the experiments of Deville, Bunsen, and others; but he (Mr. Foulis) thought some reference might have been made to the more practical experiments of Mr. Frederick Siemens, and to the views expressed in the papers communicated by him to the London Section of the Society of Chemical Industry, to the Royal Institution, to the Iron and Steel Institute, and to other societies. He had himself had occasion to make a series of experiments on the combustion of explosive mixtures; and also on the management of flame, so as to produce uniformity of temperature throughout retort furnaces. Many of the investigations were of considerable interest; but the apparatus was difficult to manipulate, and not suited for a lecture-room. The rate of progression of flame in a combustible mixture was a matter of great importance. The method adopted to ascertain this rate described in the paper—calculating the velocity from the pressure of the issuing gas—required much care to obtain accurate results. It was easier to note the time taken by flame to travel through a tube of a given length—say, 50 or 100 feet—filled with an explosive mixture. The effect of pressure on the rate of progression had not, so far as he knew, been determined. It was a matter well worth accurate investigation; indeed, the whole subject of the effect of pressure on combustion deserved further study. This pressure had a considerable effect, there could be no doubt. Compression raised the flame temperature. Mixtures of air and gas, which at atmospheric pressure could scarcely be ignited, would burn rapidly if compressed. The management of combustion so as to produce the flame best suited for the purpose to be served required to be carefully attended to. A flame which was suitable for one purpose might not answer for another. A Bunsen burner gave a high flame temperature with complete combustion, but there were many cases for which it was quite unsuitable, and where more extended combustion was necessary. He had had considerable experience in the introduction of the system of heating by gas the retorts in the gas-works under his care. In the first attempt made, the gas was introduced in comparatively small jets, and so arranged as to be immediately brought into intimate contact with the heated air; and the result was a number of short flames and intense local heat which melted the brickwork, though this was of the best quality. The ultimate success of this system of heating depended in a very great degree on the method by which the air and gas were brought together, so as to produce lengthened combustion and an equal heat throughout the entire setting. There could be no doubt that many failures in heating furnaces of various kinds had been due to want of attention to the method in which the combustion had been accomplished. On the question of the temperature of dissociation, he was inclined to agree with the opinion expressed by Mr. Siemens, in a paper communicated to the Society of Chemical Industry,† that many of the results which were attributed to dissociation were, in reality, due to imperfect combustion. One of the most frequent causes of imperfect combustion was surface interference with the free motions of the gases during combination. In the burning of gas for the purposes of illumination, it was all-important that there should be no interference with the free motions of the gases. There should be no cross currents, or, indeed, currents of any kind; and the best results were obtained when the gas was allowed to issue from the burner into a still atmosphere at so slow a rate that it might be said to be practically at rest. The experiments referred to in the paper, which established the theory of dissociation, were made on very small quantities of gas; and the mixed gases were exploded in narrow tubes, the surfaces of which were cold. What influence these surfaces would have in checking combustion, or in producing imperfect combustion, had not been determined; but no one accustomed to experiment on the combustion of gases or flame temperatures, would doubt that it must have been very considerable; and from the manner in which the experiments were made, imperfect combustion would have all the appearance of dissociation

* *Op. cit.*, and Phil. Trans., Vol. CLI., 1861, p. 629.
† "Common Sense for Gas Users," by R. Wilson, p. 19.
‡ "Heat considered as a Mode of Motion," by J. Tyndall, F.R.S., 1865, p. 50.

* *Journal für Gasbeleuchtung*, Vol. XIX., p. 761; Min. Proc. Inst. C.E. Vol. XLVIII., Part II., p. 329.
† See Journal, Vol. XLVI., pp. 55, 780

Mr. Siemens had suggested, in the course of a paper read by him before the Royal Institution, that Bunsen's experiments should be with gas enclosed in a sphere instead of a cylinder, the surface of which would be less in proportion to the cubical contents; and, by comparison, some idea of surface effect would be obtained. One circumstance of importance connected with dissociation of gases at any known flame temperature was the fact that all flames when burning freely without contact, shortened as their temperature was increased. If even partial dissociation took place, there would necessarily be a lengthening of the flame; but in all cases when the flame was allowed to burn without interference, it shortened with the rise of temperature. Nor did there seem to be any limit to the increase. A very good illustration of this shortening was seen in the case of the regenerative gas-burners now in common use, in some of which very high flame temperatures were reached. When the burner was cold, and the flame necessarily supplied with cold air, it was long and smoky; but as the temperature increased by the heating of the air supply the flame shortened, and in the best regenerative burners the gas burned with a comparatively short flame of high temperature and great brilliancy. The same thing was seen in a Bunsen burner, the flame temperature of which increased as the mixture of air and gas approached the proportions required for perfect combustion; and as the temperature increased, the flame shortened. Experiments with mixtures of air and gas in the exact proportions required for complete combustion could not be made unless the combustion took place in closed vessels, because there would otherwise be a certain admixture of air from the outside of the flame which would, of course, interfere with the accuracy of the results. When a mixture of air and gas in the exact proportions required for combustion was burned in a close chamber, or otherwise protected from the atmosphere, the flame shortened so much that combustion seemed to take place without any visible flame. There were several ways in which this might be demonstrated. [At this stage Mr. Foulis showed, by means of a beautiful experiment, that a big smoky coal-gas flame entirely disappeared when when a current of air of the requisite quantity was introduced into the gas. The end of the burner being covered with a small unglazed porcelain "test," the surface where the combustion took place was raised to an intense white heat of great brilliancy.] Mr. Rowan's paper had concluded with some remarks on the luminosity of flame; and in regard to this subject Mr. Foulis stated that the theory held by (he thought he might safely say) all who were engaged in the manufacture of gas for the purposes of illumination, was that the luminosity was due to free carbon in the flame. In a paper read by Mr. Siemens before the Iron and Steel Institute,* he thus described the theory commonly accepted:

> It will be interesting to consider for a moment the cause of flame becoming luminous. This luminosity is due to free carbon, liberated by the hydrocarbons in the flame being heated up to the temperature of the flame itself. These solid particles, becoming incandescent, act like tiny incandescent gas lights, each particle of free carbon throwing out heat and light in all directions, until consumed and converted into carbonic acid gas which is transparent, and therefore does not radiate light and heat, although its temperature may have increased during the change. The free carbon is always the last component part of the flame to burn; and, in cases of imperfect combustion, instead of becoming incandescent and luminous, it is precipitated as soot when deposited in chimney flues, and as smoke if carried along with the products of combustion, which, issuing from chimney-tops, is so very objectionable in our towns and manufacturing districts.

It was this theory, said Mr. Foulis, which had guided the work of those who had endeavoured to improve the illuminating power of coal gas. It was known that this free carbon might be produced from a flame of coal gas; and it was also known that the best photometric results were obtained when the flame was just on the point of smoking—that was to say, when the separation of the carbon was at a maximum, consistent with complete combustion. The combustion in an ordinary gas-flame took place on the outside of the flame only. The gas in the interior of the flame, where no combustion could occur, was subjected to a high temperature. As was well known, hydrocarbon gases, when subjected to a high temperature, parted with a certain proportion of their carbon; and therefore it was that thick flames were, as a rule, smoky flames. The high results given by gas consumed in regenerative burners (in many of which the light yielded per cubic foot of gas was double, and in some cases considerably more than double that obtained when the gas was burned in the ordinary way) was not entirely due to the heating of the air supply, but in a great measure to the more intense combustion permitting the use of thick flames, in the interior of which there was greater room for the separation of carbon. An examination of any of these burners would show that the gas issued from openings very wide as compared with the small orifices of the ordinary burner. It would probably be too much to assert that there could be no luminosity without solid particles; but he thought it might safely be said that all artificial illumination was derived from incandescent solid matter. This was quite apart from the question as to whether gases, when consumed under high pressure, gave out luminous effects. There could be no doubt, as stated in the paper, that barometric pressure had a considerable effect on the luminosity of gas-flames. In all photometric testing, a correction was made for the difference in volume due to the atmospheric pressure and also to the temperature; but this only touched one part of the question. It was, however, too intricate a subject to be dealt with in a discussion on the general question of the nature of flame.

*See JOURNAL, Vol. XLVIII., p. 654.

Mr. ROWAN briefly replied to the remarks of Mr. Foulis. He admitted that he had not dealt with the practical applications of flame; but he had desired to put into a convenient form the information that was available on such points as the nature, temperature, propagation, and luminosity of flame, as he believed that the more the understanding of these points became general, the more easy it would be for specific applications of flame to be made intelligently. He was aware, of course, of the views expressed by Mr. Frederick Siemens on the subject. He did not, however, take notice of them in his paper, as he did not believe in Mr. Siemens's views generally on the nature of flame, and he was satisfied that those to which he had himself given expression were the sounder. In regard to the method of estimating the rate of flame propagation, as suggested by Mr. Foulis, it seemed to him not to be a very accurate one, because it introduced the element of contact with the surfaces of the tube containing the gas—the very thing that it was desirable to avoid. Then, as to the effect of pressure of the gases, he had noticed this matter in his paper; and at this stage he gave instances of some experiments made on the rate of propagation of flame, specially referring to those carried out by Mr. Dugald Clerk. The experiments which had been made were few, and were not to be understood as being final; yet there was no doubt at all that pressure tended to increase the temperature, and therefore the luminosity of flame. The most interesting experiments made to show the effect of pressure on the luminosity of ordinary flames, such as were in common use, were those carried out by Professors Tyndall and Frankland on the combustion of candles on the top of Mount Blanc, where they found that the rate of combustion was the same as that observed at a lower level, but that the luminosity was very much less than at the lower levels. As to the question of dissociation, he did not think anything could be proved from the fact that the hotter flames were shorter, unless there was along with this the gradual shortening of flames by increasing the temperature of the gas and air. It was a fact that flames—and even large flames—were very much shortened by increase of temperature. In the Dalmarnock Gas-Works, of which Mr. Foulis had the oversight, he (Mr. Rowan) understood that the flame produced was, generally speaking, a flame of carbonic oxide. He supposed it was almost all coke that was used in the gas producer. If so, the flame would be shorter than if there had been hydrocarbons in the producer gas, because they required a longer time to complete combustion. Mr. Foulis had spoken of the flames produced in the retort-setting at first as being short and very hot, causing an intense local temperature; and that it was necessary, by introducing colder air or in some other way, to prolong the flame, and so distribute the heat more evenly.

Mr. FOULIS: Not by introducing colder air; but by introducing hot air the flame was prolonged.

Mr. ROWAN (proceeding) said that he should like to make a few remarks as to the question of luminosity. He was afraid that Mr. Siemens's theory on this point would not stand the test of very severe criticism; for, although it was quite possible that the flame of hydrocarbon gases might contain solid particles, yet nobody had ever proved that these particles influenced the degree of luminosity, or that they were solid carbon. The black deposit produced by presenting a cold surface to the flame of hydrocarbon gas was not carbon. It was, he said, a hydrocarbon compound. It had, to a certain extent, been shown that there were present in those flames some kind of solid particles, by the experiments of Soret and Burch, who proceeded by throwing the light of the sun on the surface of flames, and finding that the light so thrown on was reflected from the flame, then examining its degree of polarization by a Nicol prism. Yet although it was assumed that the light so reflected was thrown from solid particles, it had never been proved that the luminosity of the flames was due to the presence of these bodies. It was not, as Mr. Foulis had remarked, to be thought that in no case would luminosity be due to solid particles; but the balance of evidence was, he was fully persuaded, strongly against it, and in favour of the theory which had been advanced by Professor Frankland—viz., that the luminosity of flames was much more due to the temperature of the flame, and to the relative density of the vapours produced by chemical union of its constituents, than to the presence of solid particles.

IN the JOURNAL for the 16th ult. we stated that the salaries of the Gas Engineer of the Darlington Corporation (Mr. T. Smith) and his assistant (Mr. J. S. Nichols) had been advanced by £25 per annum. We are pleased to learn that the Town Council, at their meeting last Thursday, decided to make the increase to Mr. Smith £50 per annum; and to allow Mr. Nichols's advance to date from January last year.

WE learn from a correspondent that the incandescent electric lights in St. James's Hall were so dim last Wednesday evening, that from his seat in the stalls it was impossible to distinguish the features of the artists engaged. As there are something like 170 lamps, in clusters of three and six, employed to light this hall (the large one), it is not surprising that, as our correspondent says, loud and frequent complaints were to be heard from the audience of the semi-darkness in which the place was enveloped. Towards the end of the first part of the programme, one of the four gas sunburners with which the hall is provided was suddenly turned on; and the orchestra was at once brilliantly lighted. This agreeable change was fully appreciated by the audience, who testified their approval of this gracious act on the part of the management by greeting it with rounds of applause.

OHIO GASLIGHT ASSOCIATION.

The Fifth Annual Meeting of this Association was held at Mansfield, Ohio, on March 20 and 21, under the Presidency of Mr. THOMAS WOOD, of Sandusky. In the course of the preliminary business, a motion for reimbursing the authors of papers read at meetings, for actual expenses incurred in collecting data, &c., was adopted. The items of such expenses it was decided were first to be examined and approved by the Finance Committee.

The PRESIDENT afterwards delivered his Inaugural Address. He made reference to the various competitors against the interests of the gas industry—such as the electric light, natural gas, and various new schemes for manufacturing illuminating gas—and expressed a hope that useful information as to the best way of meeting these competitors would be forthcoming at the meeting. The Secretary, he said, had put the following question to each member:—"What subject do you prefer to have discussed at our fifth annual meeting?" In three out of every four responses, the subject of "Fuel Gas" was mentioned. He then proceeded to treat this subject at some length; being evidently in favour of a "go-ahead" policy in respect to it. While stating that good progress had been made, he admitted that, up to the present time, nothing had presented itself that came up to the specifications of a perfect fuel gas for distribution in cities. But he trusted that the ensuing year would see this an accomplished fact. A cheap fuel gas that could be carburetted for lighting purposes, appeared a likely solution of the problem, though an uncarburetted gas in connection with the incandescent burner might prove a successful system. The advisability of changing the name of the Association to "The Ohio Gas and Electric Association" was to be considered at the meeting; and he favoured the change, provided that a majority believed that gas companies would eventually have to deal with electricity and illuminating and fuel gas.

Mr. E. PRINTZ, of Zanesville read a paper entitled "Is the Supply of Natural Gas in Ohio Valley Failing." He said it was very difficult to obtain statistics or reliable information upon this subject. Persons interested in the sale of drilling machinery, gas supplies, and processes for the treating and use of the gas were naturally loath to give information; yet it was rumoured in regard to certain districts, that investors were trying to sell out, as the wells were undoubtedly failing. Professor Orton, in the course of a paper read before the Association of Ohio Mining Engineers, had stated that the Northern Ohio gas-field was opened by the drilling of the first well at Findlay in 1884; and that the full supply was reached in 1886. Yet some of the laws of exhaustion already began to appear. It was pretty evident a large well at Findlay would exhaust itself, if unrestrained, in about three years. Wells had given out within that period in many instances; and although there was a large area—perhaps some 250 square miles—of gas-producing territory in Ohio, it could not yet be said whether or not the new wells would last as long as the old ones, or how far the old ones had drained the gas rock. The pressure had been reduced to some extent in localities that had been well-worked. The wells within the city lines of Findlay had shown serious diminution of supply; and some of the manufacturing establishments had been obliged to "shut-down." Several of the wells had shown sure signs of approaching death, by being drowned out, as such wells usually were; the pipes being filled with salt water. Professor Orton had recommended that the use of natural gas should be confined to domestic purposes only; its application for manufactories on the large scale being discountenanced. A great mistake had been made in offering natural gas free of charge to manufacturers, in order to induce them to locate, and otherwise encouraging its use on an extravagant scale. The Professor anticipated that the supply of gas to large concerns at nominal prices would all be altered in the course of a very few years, and that the coal trade would come to its rights again. In the discussion that followed the reading of Professor Orton's paper, Mr. Haseltine stated that the Washington gas-field in Western Pennsylvania was failing so rapidly as to alarm those interested in it. Another speaker said that the Pittsburgh manufacturers did not conceal the fact that they thought the supply of natural gas to that town would be very short. Professor Lesley, the State Geologist of Pennsylvania, spoke of the oil and gas supply which had characterized the last twenty years, and probably would characterize the next ten or twenty years, as a temporary and vanishing phenomenon, which young men would see come to its natural end. He insisted upon the necessity for every possible precaution in the way of avoiding waste, both of gas and of oil. Several other opinions to the same effect were also quoted. Another sign of the failing of the natural gas supply, continued Mr. Printz, was the passing of enactments by the States of Ohio, Indiana, and Pennsylvania, for the prevention of waste of gas. Many of the companies were increasing their rates, and refusing to supply except for domestic purposes. The largest natural gas company in Pittsburgh had given notice that, on and after May 1, no gas would be supplied except by meter; and the price would be 6d. per 1000 cubic feet. At Findlay, the prices were to be doubled. In several towns, a shortness of supply had been experienced during the past winter. At Bellaire, a process for the treatment of natural gas for illuminating purposes had to be discontinued on account of the loss of pressure, and a return made to the old coal gas; and in several other towns, the use of natural gas was being replaced by water gas, coal, &c. The author thought that the question which formed the title of the paper might be answered in the affirmative.

In the discussion which ensued, Mr. Cantine said he would be glad to hear the opinion of the writer of the paper, as to whether the manufacturing interests in the gas districts had been benefited by the discovery and use of natural gas. He did not oppose the natural gas interests, and thought there were purposes for which it might well be applied; but he was sceptical as to whether it had been of any advantage to the manufacturers. Mr. Taber did not agree with Mr. Cantine, but considered that the manufacturing interests had benefited greatly by obtaining natural gas at cheaper rates than coal. No doubt the supply had diminished a little, but not so manifestly as they were led to believe; and he ascribed the increase of prices noticed in the paper to ordinary business policy, and to an appreciation of the fact that the gas was worth more than solid fuel. The suppliers would not, of course, object to a belief that the supply was rapidly being exhausted. He did not doubt, however, that the gas-wells would eventually play out. Mr. Somerville highly appreciated the paper, and strongly recommended it to the consideration of those who were thinking of putting money in the natural gas business. Considerable difficulty had arisen in many places by laying on the gas too lavishly, so that the wells and pipes were not nearly equal to the enormous draught upon them in cold weather. He used natural gas as a fuel in his boiler-house, and also under his retorts. It was very nice, clean, and reliable; and so cheap that he could carbonize a ton of coal for about 1s. He found that 26,000 cubic feet of the gas were equal in caloric effect to a ton of coal. He quite agreed that the natural gas was a product of petroleum; and therefore its exhaustion was only a question of time. Everything should be done in the way of utilizing it, and using it properly. Mr. Coombs said he had found it advantageous to buy natural gas for use as fuel, at 5d. per 1000 cubic feet by meter, and to sell his coke at 12s. 6d. per ton. Each bench of retorts required about 15,000 cubic feet of the gas per 24 hours. But the use of the natural gas ruined his coke trade; and so he was obliged to burn the coke to get rid of it. Mr. Richelderfer said he was supplying natural gas at Lima, and also making artificial gas. The former was used entirely as a fuel; and he did not speak very favourably of this part of the business. As to whether the gas had been of any benefit to manufacturers, he instanced a large paper-mill that had saved £2400 per annum by substituting the gas for coal under their boilers. A gas-well was a thing to be looked after and cared for. If allowed to exhaust itself too far, the salt water would get in and spoil it. No doubt the Findlay gas-field had been much overworked; and sooner or later the natural gas would have an end. Some time ago he made water gas, but now found it cheaper to make coal gas with natural gas as a fuel. The worst competitor he had was oil, which, when properly burned, was about the cheapest fuel he could get. Mr. Coverdale believed it was understood among geologists that the natural gas wells were unreliable, and instanced a report made to a natural gas company by the State Geologist of Pennsylvania, in which it was recommended that a sinking fund should be formed for the repayment of the capital, owing to the uncertainty of the wells holding out. Mr. Evans thought that, when once certain manufacturing industries were established in the gas-fields with a supply of cheap fuel, others using high-priced coal could not compete with them, and were forced to follow into the natural gas districts. Even then they had to get accustomed to the new fuel, and could not compete with those who were more experienced in its use. Mr. Gwynne said he had no doubt as to the natural gas being beneficial to manufacturers; but in many districts, its cheapness had attracted too many new manufacturing interests. Mr. Ross remarked that he had been very successful in making the natural gas into 24-candle illuminating gas. He could make 30-candle gas; but it smoked. Mr. Printz, in reply, said many of the firms that moved into the natural gas districts were almost bankrupt before they came; and therefore they could not be expected to last. Where coal was obtainable at a moderate price, it was of no advantage to a substantial firm to move; but if the price of coal was very high, it might be worth their while to go to a natural gas district. The glass manufacturers stood in a peculiar position, as it was not only a question of price of fuel, but the natural gas yielded a better quality of glass.

AT the exhibition now being held in connection with the Health Congress at Hastings (to which reference is made elsewhere), the Schülke Gas-Lamp Company have a very attractive exhibit, arranged under the auspices of their local representatives, Messrs. Liddiard and Wordley, Limited. It consists of the following samples:—(1) Two small lamps, each consuming less than 3 cubic feet of gas per hour, and giving a light equal to 15 candles. (2) Two lamps, each consuming 3½ cubic feet of gas per hour, and giving a light equal to 18 candles, fitted on standards; and two similar lamps suspended in harp fittings. (3) A lamp, fixed in an ordinary lantern for street lighting, which consumes less than 5 cubic feet of gas per hour, and that gives the light of 30 candles. These lamps have a patented arrangement for lighting with the usual torch, or they may be fitted with a bye-pass, keeping them constantly alight, with a consumption of gas, when not required for illumination, which would not cost 2d. per week. (4) A lamp consuming 12 cubic feet of gas per hour, having 120-candle lighting power, adapted for internal or external lighting. These lamps can be made of any size up to 1000-candle power. We believe the Schülke lamp is attracting considerable attention among gas companies and others, owing to its ready adaptability to existing domestic fittings; and the fact that it is not affected by draughts renders it especially suitable for corridors, halls, &c.

Register of Patents.

HOLDERS FOR GAS-BURNERS.—Whitehead, D., and Ball, W., of Birmingham. No. 5944; April 21, 1888. [6d.]

This invention refers to the combination of three flat-flame burners in a half-circular holder or case at such an angle as to create a flame which will "effect thorough combustion" of the gas.

GAS MOTORS.—Johnstone, G., of Springburn, N.B. No. 8252; June 6, 1888. [8d.]

This invention refers to a motor, to work with combustible gas or vapour, fitted with a cylinder open at both ends, and with two pistons in it, termed "quick" and "slow" pistons. There are two crank shafts geared together, so that the one which is connected to the quick piston makes twice as many revolutions as that which is connected to the slow piston. The strokes of the two pistons may be in various ratios; but it is preferred to make them equal, and to arrange the relative positions of the cranks so that the slow piston completes its inward movement a little after the quick piston has begun one of its outward movements. Just before the slow piston finishes its inward movement, the two pistons are in contact or nearly so; but the rapid motion of the quick piston causes a separation even before the slow piston begins to move outwards. At this stage the explosive mixture is admitted through a suitable valve. The space between the pistons increases to some extent; but the return inwards of the quick piston diminishes the space, and causes compression of the explosive mixture. The space between the pistons afterwards enlarges again, and rapidly acquires its greatest extent, when both pistons are at or near the outer ends of their strokes. At the beginning of the enlargement of the space, the explosive mixture is ignited by any of the devices now in use in gas motors. As soon as the space begins to diminish again, an exhaust port is opened; and as the pistons approach very near each other, the gaseous products are expelled in a practically complete manner. The actions thus described constitute the cycle of the motor, and are repeated once for every revolution of the crank to which the slow piston is connected.

MOUTHPIECES AND LIDS OR COVERS OF GAS-RETORTS AND OTHER VESSELS REQUIRING GAS-TIGHT JOINTS.—Westwoo ', W. H., and Wright, E. T., of Brierley Hill. No. 8551; June 11, 1888. [8d.]

This invention has for its object the construction of gas or air tight joints between the mouthpiece and lid door or cover of a gas-retort or other vessels, as well as the protecting of the seat or joint from deposit upon it of tar or dirt.

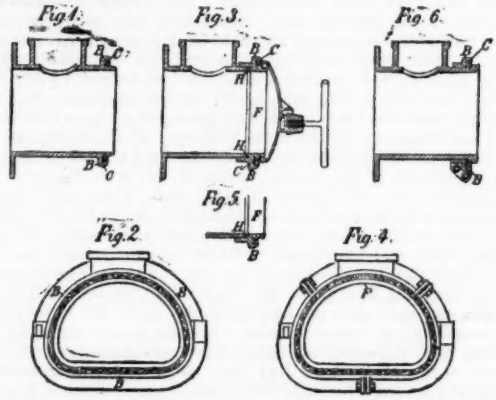


Fig. 1 represents in vertical section, and fig. 2 in front elevation a gas-retort mouthpiece constructed according to the present invention, in which a "set-back" ring-piece B, carrying the flexible seat or joint for the lid, is made in one piece with the mouthpiece. C is a dovetail or undercut groove in the ring-piece, and in which fire-resisting and flexible material to form the joint or seat for the lid is placed.

Fig. 3 represents in vertical section a mouthpiece and lid together with the fixing appliances of the lid. Fig. 4 is a front elevation of the mouthpiece fig. 3; while fig. 5 represents a modification of the mouthpiece. In the arrangements represented in figs. 3, 4, and 5, the set-back ring-piece B is made in a separate tubular piece F (forming the front end of the mouthpiece) in three parts bolted together by flanges.

The back part of the tubular piece (constituting the front of the mouthpiece) is made of a diameter proper for fitting on the outside of the mouthpiece; a cement or other joint at H being used between the end of the mouthpiece and the shoulder on the tubular piece. The lid or cover of the mouthpiece is fixed in its place by a cross-piece and screw of the ordinary kind; and it has a rim the face of which bears against the flexible joint or seat in the set-back ring of the mouthpiece. The manner in which the rim of the lid seats itself on the flexible seat is seen in fig. 3.

Fig. 6 represents in vertical section a mouthpiece in which the set-back ring-piece is made separate from and fixed outside the front of the mouthpiece. This separate ring-piece is made in three or more parts bolted together as represented in fig. 4.

The projection, or part of the mouthpiece in front of the flexible joint or seat, may be made of a double dovetail or undercut in the manner generally understood by the term "throated," or of such other form as will prevent tar or dirt getting on to the flexible joint by adhering to or running upon the underside of the mouthpiece.

TURNING ON AND OFF THE SUPPLY OF GAS TO THE WING LIGHTS, GROUND ROWS, AND TO THE STAGES OF THEATRES, &c.—Tollerton, J., of Leeds. No. 9480; June 29, 1888. [8d.]

The object of this invention is to provide means for turning on and off the gas of temporary lights in connection with theatres, public halls, and the like, without using a wet dip as heretofore. By the arrangement the stand-pipe cannot be taken out without turning off the gas; and it has only to be pushed into position and turned one-quarter round to turn on the gas and lock the stand-pipe by means of wings on the collar passing under the coverplate.

SELF-REGISTERING WATER-METERS.—Meinecke, H., of Breslau, Germany. No. 15,616; Oct. 30, 1888. [8d.]

The object of this invention is to provide generally an improved system of automatically registering the quantity of water or other liquid passing through a meter; but especially for the use of water-works in detecting leakage, and recording the quantity of water lost by such waste within a certain space of time.

For the purposes of the invention, the patentee proposes to employ any liquid meter, the recording dial of which is isolated and provided with projecting points at intervals, against which the hands of the meter must strike in their rotative motion, and thereby close an electric current (produced by a battery or otherwise), which, in passing round an electro-magnet, attracts an anchor or lever, the opposite end of which is in this way moved towards a marking medium. Between the anchor or lever a slip of paper or a tape, or any other suitable material, is caused to move regularly by clockwork or some similar mechanism. In consequence of this arrangement, the action which takes place is as follows:—The liquid passing through the meter causes the hand to rotate, and whenever it touches one of the projecting points, the electric current is closed, causing a movement of the anchor or lever, so that the paper or tape (which is kept in regular and constant motion by a clock or similar mechanism) will be brought in contact with a medium that impresses a mark upon it. As the spaces between the raised points on the meter-dial correspond with a certain quantity of liquid passing through the meter, and the paper slip or tape moves a certain distance forward in a given time, it follows that the quantity of liquid passed through the meter in this time may easily be calculated from the length of paper or tape passed, and the number of marks impressed upon it.

APPLICATIONS FOR LETTERS PATENT.

6776.—WORTHINGTON, J., "Improvements in gas, oil, and carbon lamps for the purpose of increasing or enriching the illuminating power of the flame." April 23.

6805.—PAGET, L., and KINTNER, C. J., "Improvements in the manufacture of hoods or mantles for burners used in incandescent gas-lighting." April 23.

6833.—THWAITE, B. H., "Improvements in methods of generating water gas and other like combustible gases for heating, lighting, and motor purposes, and in apparatus therefor." April 24.

6920.—KREISSIG, C., and SEIM, O., "Method of producing an increased light effect of gas, paraffin, and other flames." April 25.

6991.—KITSON, A., "Improvements in carburetting gas-lamps." April 26.

7054.—WALROND-SMITH, T., "Improvements in the manufacture of water gas, and apparatus for that purpose." April 27.

CONTEMPLATED REDUCTION OF THE PRICE OF GAS AT MANCHESTER.—In seconding the motion for the approval of the Gas Committee's minutes at the meeting of the Manchester City Council last Wednesday, Alderman Sir John Harwood mentioned "for the satisfaction of the Council," that the Committee had under consideration the question of reducing the price of gas. Alderman Shaw expressed the hope that the Council would pause before this was done.

SOUTHAMPTON GASLIGHT COMPANY.—The Directors of this Company, in their half-yearly report, presented to the shareholders at their meeting last Wednesday, had the satisfaction of announcing that there had been an increase in the sale of gas and an improvement in the value of the residual products. The profit and loss account showed that the amount available for dividend was £8835. From this the Directors recommended the payment of the maximum dividends (amounting to £7020 for the half year) on all classes of shares, less income tax; leaving a balance of £1815 to be carried forward. The Chairman, Mr. R. C. Hankinson, J.P., in moving the adoption of the report, made brief reference to the water gas projects which have been paraded before the public of late. He said he did not think there was the least cause for alarm by shareholders in coal gas companies; and he thought the high premium to which water gas shares had advanced showed that the promoters of those concerns had done their work well. The motion having been seconded, Mr. J. B. Paddon, the Consulting Engineer, made an interesting statement in regard to water gas, and explained the process of its manufacture. Water gas might no doubt be made very useful for heating in foundries. If, however, it was to have any direct bearing upon coal gas enterprise, it must be somewhat better and cheaper than coal gas; but it was neither one nor the other. The motion was carried; and some formal business having been transacted, and the usual recognition of the services of the Secretary (Mr. C. C. Smith) and Manager (Mr. S. W. Durkin) having been made, the proceedings terminated.

GAS EXHIBITION AT WORKINGTON.—Last Tuesday an exhibition of gas appliances was opened in the newly-incorporated borough of Workington by the Mayor (Mr. H. F. Curwen). It was mainly promoted by the Corporation Gas Committee; Mr. Herbert Lees, the Gas Manager, having charge of the arrangements. The show was an excellent one throughout; the only drawback being the absence of gas-engines. Gas-testing appliances were shown by Messrs. Alex. Wright and Co. Messrs. W. Sugg and Co., Limited, were represented chiefly by varieties of their "Christiania" and London Argand burners, and various forms of their "Cromartie" light, and also exhibited a sample of their Armstrong light, to show its adaptability to the Cumberland steel-works. The Wenham, Bower, Clapton, Chandler's Silver, and the "Empress" lights were shown by Mr. R. E. Banks, of Workington; while Mr. D. M. Walker, of that town, exhibited samples of the "Comet," Albo-carbon, Fourness, Argand, City of London, and Manchester lights. Messrs. Greene and Son had a couple of "Meteor" lights on view; Messrs. Stott showed their "Reflex Sunlight" (with their governor); and Mr. Frank Wright, of Messrs. A. Wright and Co., exhibited varieties of the Schülke and Welsbach incandescent lights. Cooking-stoves, boiling-burners, and gas-fires were exhibited by Messrs. T. Fletcher and Co., Messrs. J. Wright and Co., Mr. W. Unsworth, Messrs. R. and A. Main, Messrs. C. Wilson and Son, and the Carron Company. Models of gas-works, show meters, and a loan exhibition of coal tar products completed an exceedingly well-arranged exhibition. Mrs. Thwaites, of Liverpool, gave a series of lectures on cookery; and a public supper, the food being all cooked by gas in a most successful manner, was held. The exhibition remained open till Saturday.

Correspondence.

[We are not responsible for the opinions expressed by Correspondents.]

COUNTY AUTHORITIES AND THE LAYING OF MAINS ON BRIDGES.

Sir,—Gas and water companies, when under statutory regulations, but not otherwise, are entitled to occupy the public roads with their mains, whether over bridges or elsewhere; but only to such an extent as circumstances will permit without inconvenience to the general public. If a company were to lay a main in a public road where there was not sufficient depth of soil to cover it, they would be liable to indictment for a nuisance, notwithstanding their statutory powers. If a main cannot be laid in one direction without inconvenience or becoming a nuisance, it must be laid in some other direction, without regard to the cost. The authorities cannot be called upon to alter their roads for the accommodation of gas and water mains. The owners of roads have the right to deepen the soil over bridges; or, whether they have the right or not, they frequently do so to accommodate gas or water companies. But then there is a right and a wrong way of going about these matters; and much depends upon the course you select.

W. Livesey.

Gas Companies' Association, 76, Palace Chambers, Westminster, May 3, 1889.

THE COST OF ELECTRIC LIGHT IN PARIS.

Sir,—Since I wrote to you on this subject (*ante*, p. 812), I have received copy and conditions of contract between the Continental Edison Company and the consumers, as sanctioned by the Prefect of Police of Paris. The provisions are numerous and precise, and some of them may interest your readers.

The consumer must pay for the conductor from the electric main to the meter; both of which, however, are to be fixed by the Company.

The consumers must provide a meter, to be tested and approved by the Company, or pay rent on the following scale:—

5 ampères	. . . . .	2·50 frs. per month.
10 „	. . . . .	4·00 „ „
20 „	. . . . .	5·00 „ „
40 „	. . . . .	6·00 „ „
100 „	. . . . .	10·00 „ „

As the current is to be delivered at 100 volts, each ampère represents about two 15-candle lights. A consumer using 10 lights would therefore have to pay 24s. a year meter-rent, or about the total value of a gas-meter sufficient for that number of lights; and a consumer using 20 lights would have to pay nearly £2, or 2s. per lamp per annum, for meter-rent alone.

On the signing of the contract, the consumer must pay for service and meter (if bought), and must also deposit in advance 7 frs. for every incandescent, and 30 frs. for each arc lamp. The smallest consumer contemplated by the tariff must, therefore, pay £2 8s. deposit for his 10 glow lamps.

Rental accounts, furnished *monthly*, must be paid within five days, under penalty of cutting off the current. In case the Company, from any accident, fails to supply light, it is indemnified from penalty.

The price to be charged is 0·15 fr., or nearly 1½d., for 100 watt-hours. Allowing 60 watts per 16-candle lamp *at the meter*, this means 0·09 fr. per lamp per hour. Now, 1000 cubic feet of 16-candle gas will supply one 16-candle light for 200 hours. If we multiply the 200 hours by 0·09 fr., we have 18 frs., or equivalent to about 14s. 5d. per 1000 cubic feet of gas.

The contract states that 100 watt-hours will produce 3·4 Carcels light per hour. Taking each Carcel as 8·3 candles, as the French themselves have estimated it, we have 3·4×8·3=28·22 candles—per 0·15 fr. This works out to nearly 17 frs., or 13s. 8d., per 1000 cubic feet for 16-candle gas; but this is without making any allowance for the inevitable loss from resistance and leakage between the meter and the lamps. If the comparison were made with cannel gas, the Paris price for electric light would seem still more extravagant.

The price to be charged for motive power is 0·45 fr., or nearly 4½d., per horse power per hour. At 18s. a ton for coal, this would pay for 45 lbs. of coal; and it is about six or seven times as much as gas power would cost in London.

The above figures prove very clearly that the Paris Gas Company have little to fear from their young and brilliant rivals, who charge for service wires, require heavy deposits and monthly payments, fix an extravagant rental for meters, and charge for light and power from six to ten times the price paid for the same in different parts of England.

Cork, May 3, 1889. Denny Lane.

STAPP'S WATER GAS.

Sir,—Your remarks, headed "Water Gas to the Front," in your issue of the 16th ult., p. 707, seem to require a reply from me, inasmuch as my name is referred to.

In former years, water gas has been brought forward more than once, and has conspicuously failed whenever it has been brought forward. This failure has been due to several causes; but chiefly to the dearness of petroleum, and to the defective method of carburetting the gas. At the present time all this has changed. Petroleum is now cheap; and the carburetting process, as carried out by Stapp, has been brought to a high degree of perfection. So important are these changes in their bearing on the production of illuminating gas that, by means of the Stapp process, an illuminating gas of at least the candle power of London gas can be delivered into the gasholder at the cost of about 4d. per 1000 cubic feet. The cost of gas as delivered into the holder by the London Gas Companies being at the rate of 1s. per 1000 cubic feet, the economy of the Stapp gas is obvious.

My assertion that Stapp gas will have the advantage in competition with coal gas as commonly manufactured is thoroughly justified; and the more the question is inquired into, the greater will the advantages appear.

J. Alfred Wanklyn.

New Malden, May 3, 1889.

THE "LUCIENT" REGENERATIVE GAS-LAMPS.

Sir,—In reference to the letter which appears in the current issue of the Journal from Mr. Robert R. Tatlock, seeing that we are the patentees of the above-named lamp, we feel deeply interested in that letter; and as we cannot fully comprehend the meaning the Glasgow City Analyst wishes to convey, we have no alternative but to ask you to publish his report (enclosed) to us, so that your readers may be enabled to form an opinion on the question at issue.

Alex. Brown and Co.

Glasgow, May 1, 1889.

[Enclosure]

City Analyst's Laboratory,
156, Bath Street, Glasgow, March 25, 1889.

Report on the "Lucient" Regenerative Gas-Lamp.

I have made a number of very careful tests with this lamp under different conditions of use, with the following results:—

	Consumption, Cubic Feet per Hour.	Candles per Cubic Foot.	Illuminating Power, corrected to 11 Cubic Feet per Hour.
1. At angle of 45°, without reflector	11·14 ..	12·01 ..	132·11
2. Do. Do.	10·97 ..	11·73 ..	129·03
3. Do. with reflector .	10·51 ..	14·45 ..	158·95
4. Vertical, without reflector . .	9·66 ..	17·88 ..	196·68
5. Do. with reflector .	8·29 ..	19·31 ..	212·41
6. At angle of 45°, without reflector	8·18 ..	9·58 ..	105·38

The illuminating power of the gas used, as tested with a union-jet burner consuming 5 cubic feet per hour at 5·10ths of an inch pressure, was 22·50 candles = 4·50 candles per cubic foot.

From these results it will be seen that the illuminating power of this lamp is extremely high. *This rendered it impossible to make tests at any other angles than that of 45°, although the ceiling of the testing-house was 14 feet high, which had been found sufficient for other lamps.*

Although the results with the vertical tests are given in the table, they are a long way under the truth, as this test could not be made without reducing the consumption of gas in the lamp to far below its proper working capacity. In order to determine as nearly as possible to what extent the lamp suffered from this reduction, a test was made (No. 6), which would be parallel with the first (No. 1) at 45°; reducing the consumption of gas in the same manner. The result was 26·73 candles against the lamp, which figure should be added on to the No. 4 and No. 5 tests respectively for 11 cubic feet consumed; so that these would read 223·41 instead of 196·68, and 239·14 instead of 212·41.

These results will convince anyone accustomed to lamp testing of the high illuminating power of the "Lucient" lamp.

(Signed) Robert R. Tatlock, F.R.S.E., F.I.C., F.C.S.,
Gas Examiner for Glasgow and Paisley,
Public Analyst for Glasgow.

Water Gas.—In the letter on this subject recently addressed by "Gas" to our contemporary *Engineering*, and reproduced in the Journal last week (p. 814), in connection with one by Mr. B. H. Thwaite, there was a clerical error in the equation in the tenth line of the first paragraph. The conclusion of the equation should have stood 16+2 (CO_2). The calculations were not, however, affected by the error.

Illumination at West Hartlepool.—The opening of the Municipal Buildings at West Hartlepool last week by Prince Albert Victor, was made the occasion of the largest illumination known in the history of the town. A number of devices in gas and crystal were shown in Church Street and other thoroughfares, as well as at most of the public buildings. The Hartlepool Gas and Water Company undertook gratuitously the fitting of the additional pipes to mains for the illuminations.

Birmingham Gas-Fitters' Grievances.—The committee of gas-fitters formed to endeavour to procure relief from what they consider to be unfair competition at the hands of the Birmingham Corporation, held a meeting yesterday week (Mr. Hadley in the chair), when it was reported that a canvass had been made of the members of the City Council with very gratifying results. In the great majority of instances, entire sympathy was expressed with the traders; and the canvassers were met unfavourably in only very few cases.

Reading Public Lighting.—At the meeting of the Reading Town Council last Thursday, the Highway, &c., Committee reported that the Chairman and one member of the Committee had been appointed a Sub-committee to consider the whole subject of the lighting of the town, in view of the approaching termination of the existing contract with the Reading Gas Company, with a request that they would confer on the subject with the Gas Company, and with Messrs. Laing, Wharton, and Down, the electrical engineers who have established works in Reading, and whose lamps have recently been tested for a month in the centre of the town.

The Thirlmere Water-Works of the Manchester Corporation.—At last Wednesday's meeting of the Manchester Corporation, Alderman Sir John Harwood, in moving the adoption of the minutes of the Water Committee, said they had approved the acceptance of the tender for valves, sluices, &c., required in the line of the Thirlmere aqueduct for £5641. It would be interesting to the Council and the public to know that, with the letting of contract No. 7 for £142,255, the Committee had now arranged for 79 miles, leaving only 16¾ miles to complete the contracts for bringing the water to Prestwich. With one or two exceptions, the contracts were going on satisfactorily. The motion was agreed to.

Torquay Water Supply.—Our readers may be aware that for a portion of the distance between Torquay and the water reservoirs, the mains are laid in duplicate. The first portion of the duplicate main was laid in 1878, and the second portion in 1884, at a total cost of between £13,000 and £14,000. It is now intended to complete the duplication by laying down another main from Newton and Hennock, at a cost of £10,000, sanction to borrow which is being asked of the Local Government Board. The result of the completion of the first part will be to increase the present daily supply of 1,200,000 gallons of water by nearly 200,000 gallons; whilst when the second portion is finished another 200,000 gallons will be added. These works will be carried out under the supervision of the Engineer of the Board (Mr. T. S. Weeks, Assoc. M. Inst. C.E.).

Northern Coal Trade.—The demand for coal showed less fluctuation last, as compared with the preceding week. There has been a commencement of shipments to Cronstadt and to St. Petersburg; and of both gas and steam coals there will be very large quantities sent. The steam coal collieries are well employed, and for coals for prompt shipment the price is about 9s. 9d. Small steam coals are scarce, and the price is steady at from 8s. 6d. to 8s. 9d. per ton. The demand for gas coals has shown considerable improvement; and it is believed that some of the gas companies are beginning to stock coals in expectation of labour difficulties at the coal pits in a month or so. The maintenance of stock would be found desirable from another cause—the rate of freights is lower now than is likely to be the case in the autumn. Gas coke finds a very ready sale, especially for the cement factories.

Parliamentary Intelligence.

HOUSE OF LORDS.

The following progress was made with Private Bills during the past week:—

Bills read the first time: Faversham Gas Bill, Great Wigston Gas Bill, Heywood Corporation Bill, Kettering Water Bill, Morley Gas Bill, West Ham Gas Bill.

Bill read a second time, and committed: London Hydraulic Power Company Bill.

Bills read the third time, and passed: Burnley Corporation Bill, Tuscan Gas Bill, Windermere District Gas and Water Bill.

Opposition withdrawn: Cleveland Water Bill.

HOUSE OF COMMONS.

The following progress was made with Private Bills during the past week:—

Standing Orders complied with: Belgrano (Buenos Ayres) Gas Company Bill, Garw Water Bill, Rickmansworth and Uxbridge Valley Water Bill.

Bills read the first time: Burnley Corporation Bill, Tuscan Gas Bill, Windermere District Gas and Water Bill.

Bill read a second time, and committed: Bristol Water Bill.

Bills read the third time, and passed: Great Wigston Gas Bill, Heywood Corporation Bill, West Ham Gas Bill.

Petitions were presented against the following Bills:—

Plymouth Dock (Devonport) Water Bill, by Pollexfen Copleston Colmore Radcliffe.

Wakefield Corporation Bill, by Owners, &c., of mills, &c., on Booth Dean Clough and the River Ryburn.

The Corporation of Newcastle-upon-Tyne petitioned against alteration in the Newcastle and Gateshead Water Bill.

Legal Intelligence.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

WEDNESDAY, MAY 1.

(*Before the* MASTER OF THE ROLLS *and Lords Justices* LINDLEY *and* LOPES.)

CONSETT WATER-WORKS COMPANY *v.* RITSON.

This was originally an action in which the plaintiff Company claimed from the defendant £15,000 damages, and also asked for an injunction, by reason of damage occasioned to their reservoir. The defendant is lessee, for the Ecclesiastical Commissioners, of certain mines situate on Lanchester Common, in the County of Durham, upon a portion of which the plaintiffs built a reservoir. In consequence of the defendant's mining operations, the plaintiffs alleged that the surface of the ground was let down, and injury to their property thereby caused. The matter was argued, upon certain admissions, before Justices Cave and A. L. Smith in May of last year; and their judgment, which was not given till early in the present year (see *ante*, p. 204), was in favour of the plaintiffs—a decision against which the defendant now appealed.

Mr. RIGBY, Q.C., Mr. DANCKWERTS, and Mr. LOWLESS appeared for the appellant; Sir HENRY JAMES, Q.C., M.P., Mr. J. G. WOOD, and Mr. H. F. MANISTY for the respondents.

The arguments occupied two days; and at their close, their Lordships delivered judgment.

The MASTER of the ROLLS: In this case the real question is whether the Water-Works Company are entitled to recover damages in respect of the surface of the land on which they built their reservoir having been let down by reason of the working of the mines underneath that surface, or underneath the reservoir. Now, the land in question at one time belonged absolutely to the Bishop of Durham, as lord and as owner of the manor, subject only to a right of common on the part of certain commoners. At that time, therefore, the Bishop's rights, it is not denied, were, with regard to the mines, absolute. He might have worked the mines in any way he thought right, producing any effect upon the land that might be the result of what he thought right, save only this—that he was obliged to leave out of the 30,000 acres a sufficient quantity for the exercise of the rights of common. Under these circumstances (the Bishop of Durham of those days being one of the most powerful landowners and one of the most powerful personages in England), it was proposed that there should be an enclosure; and an Enclosure Act was the result of an agreement or arrangement between the parties. Therefore, with the immense power which the Bishop had, and with the then really known value of the mines in the county of Durham, and more particularly in such a place as that under common land such as this was, one would be prepared to find that the Bishop would reserve the greatest possible power with regard to the minerals—that he would be very little inclined to give up any power and the working of them as he thought right, without reference to the consequences to anything upon the surface. Now, the right of common of the commoners was a certain right, no doubt, and to a certain extent valuable; but I think it cannot be doubted, when you consider that there were 30,000 acres of land that were going to be enclosed, that practically they would, if they got an ordinary Enclosure Act, become owners of the land instead of having a mere right to feed their cattle on the moor, and that they would get something very much more valuable to each of them than the right of common was before. Under these two views of the matter, one would be prepared to find that the Bishop had reserved to himself as large rights as one can well imagine; and that the commoners would be willing to get something which was of much more value than their mere common right, but at the same time no such absolute right as would prevent the Bishop from exercising his fullest and most valuable privileges as owner of the mines. The Enclosure Act was passed, and we have to construe it; and although much has been said about what would be the effect of the Act under the circumstances of the present times, we have to construe the Act, as we have so often said, as if we had to construe it a day after it was passed. The Enclosure Acts are not like contracts which may be casually made between individuals; they are unlike any other contract which has been made by anybody else. These Acts are of a common form which has existed for years; and whenever you have such a common form as that, where there have been decisions as to the mode of construing these Acts, it is not true, in my view, to say that the mode of construing them which has been adopted by a Court is not to be noticed by subsequent Courts. Now, has there been laid down a rule or mode of construction under which you are primarily or *primâ facie* to look at Enclosure Acts? It seems to me that such a rule has been laid down—first of all in a Court of Appeal (the equivalent Court to this Court), and, therefore, binding upon us, and afterwards adopted in the House of Lords; and that rule we are bound to follow. I take it that no rule has been laid down that, where words are clear, you are not to construe them according to their obvious intention. But one has been laid down where words are used which are capable of one of two constructions; and I think that the rule laid down in the case of *Bell v. Love* in the Court of Appeal has been adopted in the House of Lords. Take the rule as laid down by my brother Lindley in that case. Now, in *Bell v. Love* (10 Q.B. Div., 568, 569) my brother Lindley speaks of all the cases—*Rowbotham v. Wilson*, *Smith v. Darby* (which has been quoted to us), *The Duke of Buccleuch v. Wakefield*, *Hext v. Gill*, and others—and then says: "These cases appear to me to establish two propositions—first, that an Enclosure Act is not to be construed so as to allow the lord of the manor to let down the surface of allotments by working mines under them, unless the language of the Act is clearly and unmistakeably to that effect." That is a rule of construction. Then his second rule is: "That the absence of all provision for compensation for injury sustained by letting down the surface tends strongly to indicate that the Legislature did not intend, by general words, to reserve to, or confer upon, the lord of the manor the right to work his mines so as to let the surface down." That is a negative proposition—that the absence of all provision tends strongly to show that the intention was that he was not to be allowed to let down the surface without paying for it. Now, it is clear that, with regard to these two propositions—neither of them negatives what I have said before—that if there were clear words giving to the lord of the manor the power to let down the surface without paying compensation, although there is no compensation at all given, the Court is bound to give effect to the clear words. That is quite consistent with both these propositions; but if the words are not clear to the effect that the lord can let down the surface without paying compensation—if they are capable of two constructions—then this question of whether there is or is not compensation becomes a very material context. These propositions were laid down in *Bell v. Love* in order to consider whether or not that case was governed by the case of the *Duke of Buccleuch v. Wakefield*; and they were applied in this way—that although the words in *Bell v. Love* were words quite large enough to give to the lord the power of working the mines so as let down the surface of the ground without paying compensation, yet it was consistent with them that he was not to let down the surface. And then the fact of there being no compensation to any persons whose land was let down, authorized the Court to say that the generality of the words was to be construed, not in their larger, but in a limited sense. As it seems to me, these rules were adopted by the House of Lords; and this question of the effect of the absence or the presence of compensation was distinctly alluded to by each of the noble Lords who gave judgment, particularly by Lord Watson, where, alluding to the case of *Hext v. Gill*, he adopted and approved of what had been said by Lord Justice Mellish in that case. [His Lordship quoted Lord Watson's words.] Now, we must see how we are to apply the rules laid down in that case to the present. It is said here that, even if there had been no compensation given in this case, the words used in the paragraph or section are so clear and strong that even though there was no compensation given at all, they would show clearly that the Bishop had reserved to himself the right of working the mines so as to let down the surface without paying any compensation. [His Lordship here commented at length upon the words of the Act.] After the Act was made the allottees had become freeholders; and unless we can find something in this to say that they are not to have the right to have the surface unmolested, they are to have it unmolested. Would the words, if they had stopped there, have been sufficient to take this right away from these allottees, the owners of all the land except the mines? I myself hardly think so. They are to enjoy the same as if the Act had not been made; but it goes on, "And that without paying any damages or making any satisfaction for so doing." That is to say, everything which it is said the lord may do, notwithstanding the property in the surface land (and I should say in all the land except the mines) having passed to the allottees, so that they have become the legal owners of it, he may do as if the Act had not been made; "and that without paying any damages or making any satisfaction for so doing." There was considerable doubt at first whether both these last phrases applied to the whole of the section or only to a part of them; but when you come to the compensation sections, they are introduced by a recital of what, in the view of the Legislature, the Legislature itself had just done by the preceding section of the Act. What is it that they say? "And whereas great inconvenience may happen and damage be done to particular persons [What persons? Clearly the allottees] by reason of searching for [that is one], winning [that is another], and working [that is another] the said mines and quarries within and under their respective allotments." There were two sets of allotments specified—that is, not only of the more improvable parts, but also of the less improvable parts of the moor. I hear it is to be done to particular persons "by the said Lord Bishop of Durham and his successors, without paying any damages or making any satisfaction for so doing." So that it is: Whereas great inconvenience may happen by the Bishop doing these things without paying any damages or making any satisfaction for so doing. What are these things? Searching first, winning second, working third. Therefore it is: Whereas great inconvenience may happen and damage be done to particular allottees by working the mines and quarries without paying any damages or making any satisfaction for so doing. That is what the Legislature declares they have done by the section they have just passed. How have they done that by the section? It can only be by these words: That they may do these things as fully and freely as they could or might have had, held, used, and enjoyed the same in case this Act had not been passed, and that without paying any damage or making any satisfaction for so doing. This shows that the Legislature itself intended those Acts to apply to everything mentioned in the section; and, among other things, to the Bishop owning, working, and enjoying all the mines. Therefore there is an interpretation by the Legislature of their own section. If there were no compensation clause, would this be such an indication as would show that the Legislature intended that he might work the mines without paying for letting down the surface? I do not think it necessary to determine that question. I have great difficulty in saying that that would not of itself do without any compensation at all. I have great difficulty in saying that this is not so clear that, even if there had been no compensation at all given, that would not have shown that he might let down the surface—that is, work the mines; and in cases that have been pointed out during the argument, all he would or might do under certain allotments would be to work the mines under them. It is said that at all events a most probable effect of working these mines would be to let down the surface, if he worked them without leaving any props. If he did so this would let down the surface; and there it is plainly—he is to work the mines and pay no compensation at all for working them and letting down the surface. I should be inclined very much to say that this is strong enough without the compensation. But then you come to the compensation clause; and what do you find?

You find that the Legislature has, in respect of the working of the mines, given compensation. It has given compensation for the working of the mines, but it is said it is not full compensation—it is not what the Legislature has considered full compensation. The Legislature says that for damage done by the working of the mines (which one would suppose naturally includes all damage done by such working, which I should say certainly includes the damage which is almost inevitably the only damage that can be done by merely working the mines) they had given compensation. When the Legislature gives compensation in respect of all that has been done, it seems to me that they meant that to be full compensation. In this case, therefore, you have the words very strong indeed—almost strong enough to carry the matter without there being compensation, but certainly absolutely strong enough to carry it if you are to give the words their natural interpretation; and the cases seem to me to show that, where there is compensation given, you are to construe the large words which precede that compensation, and which give powers to the original owner of the land, in their ordinary sense. This seems to me to be the result of the judgment of the House of Lords in *Bell v. Love*. The moment the fetter is taken away which is put upon the construction by reason of there being an absence of compensation, and there is compensation, you must go back and construe the words according to their ordinary, and therefore their large signification; and that will oblige us here to say that the Bishop had reserved to himself unlimited power of working his mines as he thought right. The case of *Bell v. Love* seems to me really an authority in favour of that construction, because the whole case was a strong, and in my judgment a right effort adopted by the House of Lords to control the large words in that instance by reason of there being no compensation clause. The House of Lords construed what was some compensation to somebody to mean no compensation whatever to the person whose land might have been affected by the working of the mines; and it is only because there was no compensation clause in that case, as they came to the conclusion that there was not, that they distinguished it from the Duke of Buccleuch's case. If this were the only thing that could distinguish it from the Duke of Buccleuch's case, inasmuch as there is here a compensation clause, the reason for that distinction has fallen to the ground. The case comes within the rule, therefore, which was applied in the Duke of Buccleuch's case; that is, that the moment you find the compensation clause—the fetter which had been put upon the Court as to construing the large words—is taken away, you must construe the large words according to their ordinary effect. That fetter is off here; and so we are bound to construe the large words of the section according to their ordinary meaning. These words enact this—that the Bishop had a right to work the mines so as to cause damage to the surface, and so as to let down the surfaces and thereby injure any particular allottee; but that he was entitled to do this without paying any compensation whatever. I therefore cannot agree with the decision of the Divisional Court; and I think that this appeal ought to be allowed, and that our judgment ought to be the contrary of what was there given.

Lord Justice LINDLEY said he had come to the same conclusion. The principles applicable to the case were those laid down in the case of *Bell v. Love*, which was three times argued, and there was no difference of opinion between the Judges before whom it came. Having commented upon the principles which guided the learned Judges in that case, his Lordship said that in *Bell v. Love* there was no possibility whatever of any intention to leave or to confer rights upon the lord of the manor, or to preserve to him the right of letting down the surface without paying damage when damage was sustained; and the question was whether in the Act affecting the present case, there could be found any intention that this should be done. His Lordship reviewed at length the various provisions, till he came to the enactment that the Bishop of Durham was to enjoy his rights "as fully and freely as he might or could have held, used, and enjoyed the same in case this Act had not been made, and that without paying any damages or making any satisfaction for so doing." His Lordship said it appeared to him to be perfectly impossible to read these words without seeing that what was meant, and what the parties had present to their minds was, that the mines should be reserved to the Bishop, and that he should be at liberty to work them, and exercise all the powers in respect thereof which were enumerated, without paying any damage or making any satisfaction. How could it be said, in the face of this, that there was no implied power to let down the surface? He could not conceive how those powers were to be exercised, from a business point of view, without risk, at all events, of letting down the surface. But to remove all doubt about it, the compensation clause stated: "And whereas great inconvenience may happen and damage be done to particular persons by reason of searching for, winning, and working the said mines and quarries within and under their respective allotments," by the Bishop without paying for any damage done. The very thing was contemplated—the very inconveniences which might arise were foreseen and provided for; and it appeared to him that they could not, in the face of this Act, come to the conclusion that there was not an express and clear intention to confer upon the mineral owner the right to let down the surface in the course of working his mines without making any compensation for damage. The Court had been asked to hold that this was confined to damage short of letting down the surface of the ground—surface damages caused by putting things on or taking things off the ground; but he could not so read the words. It was really impossible to see what damage could be done to the surface of the ground, in the ordinary course of working a mine under it, except by letting it down; and yet, whatever the injury might be, however it might be caused, the Bishop was to be at liberty to do it without paying for any damage. It was impossible, he thought, to say, in the face of language so clear as this, that the Legislature never thought about surface support; but that they did not think about the consequence of letting down the surface of the ground was plain from the language used. But what the Court had to get at was this—whether the Legislature reserved to the Bishop, or conferred upon him, the right to let down the surface without paying any damages; and it appeared to him to be in the face of this language, impossible to deny that the Legislature had clearly conferred that right upon him. This disposed of the case. He was unable to agree with the view taken by the Court below. He thought that Mr. Justice Cave did not attach sufficient weight to what lords of the manor could do with respect to minerals; and that Mr. Justice Smith had attached too much importance to the fact, if it was a fact, that the compensation clause was inadequate to provide for cases which were never foreseen. It seemed to have been amply adequate to meet the cases contemplated—viz., the letting down of the surface whilst the land was agricultural land. It might be that this was unjust, or would perhaps work harshly, when applied to cases, if there were such, in which the allotments were covered with buildings. But this did not effect the question about the letting down the surface. In *Bell v. Love* there was no indication of intention that the surface should be let down without paying for damage. Here, however, the language was that it might be let down without liability for compensation.

Lord Justice LOPES concurred. He said he quite agreed with the observation which had just fallen from Lord Justice Lindley, that Mr. Justice Cave did not attach sufficient importance to what were the rights of a lord of the manor; and it seemed to him very material in the present case to consider what the position of the Bishop of Durham was before the Act was passed. His Lordship reviewed the position of the parties before and after the passing of the Act, and went on to remark that it had been said by the appellants that a right was conferred on the Bishop to let down the soil—to remove the support of the subjacent soil. It was said on the part of the respondents that the only right which was conferred was one to interfere with the surface—in no way a right to let down the soil. It was perfectly clear law that the burden of making out a right to let down the surface lay upon the appellants. Unless they could make out this right clearly, the presumption was that the allottees—the owners of the freehold—had a right to the support of the subjacent soil. To remove this presumption, the language must be unequivocal, whether used in an agreement, a deed, or an Act of Parliament. In the present case they had to deal with an Act of Parliament; and if the language of that Act was definite and unequivocal, he took it that there was an end of the question. If it was clear and definite in this way—that the right to let down the soil was intended to be conferred—the presumption was gone, and the right to let down the soil was beyond question. Again, if the language in the Act was large and general, and there was nothing in the context to confine and point to anything, then the presumption of the right to support prevailed. If, on the other hand, the context indicated a right to let down the surface, and that this right was intended, then effect was to be given to the general words, and the presumption would be negatived. To his mind, the language in the Act was clear and unequivocal; and he should be inclined to hold that, if there had been no compensation clause, the language would have been sufficiently clear to have authorized the letting down of the soil. His Lordship proceeded to comment at length upon the provisions of the Act, and said it seemed to him that a letting down of the surface of the ground was contemplated and was intended by the Act. He thought, therefore, the appeal should be allowed.

The decision of the Court below was accordingly reversed; their Lordships granting the appellants costs of both the former and the present proceedings.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

(*Before Mr. Justice* NORTH.)

SATURDAY, MAY 4.

GLOVER *v.* GEFLE GAS COMPANY, LIMITED.

Mr. TERRELL said this was a debenture-holder's action, commenced as long ago as 1873; and it now came on as a short cause on motion for judgment under the following circumstances:—The Company was formed in 1861, under the Companies' Act, 1856, for the purpose of taking over and working a concession for supplying the town of Gefle, in Sweden, with gas. By an extraordinary resolution, the Directors were empowered to issue debentures to the extent of £6000; and they did so by executing a mortgage for £5220, and "further advances not to exceed £6000." A declaration of trust was executed; and in pursuance thereof debentures to the amount of £6000 were issued, of which the plaintiff was the holder of £2800. The interest being in arrear, the action was commenced; and in July, 1873, an order was made appointing a receiver and manager of the gas-works. Afterwards a winding-up order was made; and in 1876 an order was granted by Vice-Chancellor Bacon directing that no further proceedings should be taken in the action except that the receiver and manager should be continued. Under the concession which the Company was established for the purpose of working, it was provided that at the end of 30 years from the date thereof the Municipality of Gefle should have the right to purchase the works by giving one year's previous notice in writing. The concession would expire next year, and notice to purchase had been given; so that it became necessary to appoint, on behalf of the Company, an arbitrator to arrange the price to be paid. This could not be done unless the action were continued; and consequently the Chief Clerk had given liberty, in the winding-up, to proceed with the action. It was proposed to take a judgment declaring the plaintiff to be mortgagee of the property in respect of the principal and interest due on the debentures, and granting an inquiry as to who were the holders of the debentures, and the amount due.

His LORDSHIP made an order as asked.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

TUESDAY, APRIL 30.

(*Before Baron* POLLOCK *and Justice* MANISTY.)

HUMPHREYS AND SON *v.* THE SOUTHWARK AND VAUXHALL WATER COMPANY

This was an appeal from an order of Mr. Justice Mathew at Chambers, discharging an order of Master Manley Smith granting a writ of *certiorari* to remove the trial of this action from the County Court to the High Court.

Mr. M'COLL, who appeared for the appellants, said the action was brought to recover the sum of £30 for damages to goods belonging to the plaintiffs by reason of a fire-plug in one of defendants' water-mains having given way, and the water thereby escaping caused the damage complained of. The plaintiff's case appeared to be that if he showed there was an escape of water, it was *primâ facie* evidence of negligence; but the defendants' case, as stated on their affidavit, was as follows: That the water-main was laid beneath the public roadway at Peckham Rye pursuant to statutory powers. In that main there was a fire-plug and box as required by the statute; the fire-plug being under the control of the Metropolitan Board of Works, or some similar public body as now existing. At the time of the alleged damage, the roadway was being repaired by the Vestry of the parish; and a steam-roller was being used. By the use of the steam-roller, or from the repair of the road, the position of the fire-plug and box was altered, which allowed the fire-plug to blow out; and the water coming therefrom was blown by the wind on certain goods belonging to the plaintiffs, which were exposed for sale on the footway. Under these circumstances, said the learned Counsel, there were various important points of law which would have to be decided; and he therefore submitted that this was a proper case to be tried in the High Court. The Master was of this opinion, and so was Mr. Justice Mathew to a certain extent, because he said he should uphold the Master's order if the defendants would undertake not to ask for costs on the High Court scale if they should succeed; but, the plaintiffs should have costs on that scale if they succeeded. He submitted that this was an unreasonable term to impose upon the defendants. If the case were tried in the County Court, there would almost of necessity be an appeal on points of law; so there would be no saving of costs at all. First of all there would be the question of law whether the escape of water from the main was any evidence of negligence, which, he contended, it was not. The pipes were laid under statutory powers; and the defendants were not bound to break up the roads from time to time to see that they were in perfect order. Accidents of this kind had frequently occurred owing to the use of steam-rollers; and it was a matter of the utmost importance

to the Company that this question of fact should not be tried in the County Court. Then there was the important question of law, which had been before the Court in a former case, and on which very distinguished Judges had differed in opinion, whether the escape of water was *primâ facie* evidence of negligence, or whether it came within the rule of *Fletcher v. Rylands*. That case was discussed before the Court of Queen's Bench, when Justice Blackburn was of opinion that it did come within that rule; while Justices Mellor and Lush inclined to the opposite belief. As, however, it was not necessary to decide it, no judgment was given. There was also another point similar to that raised in *Atkinson v. The Newcastle and Gateshead Water Company*. An action was brought against that Company for not having their mains charged, and the fire-plugs in good order; and Lord Cairns, in giving the judgment of the Court of Appeal, held that the fire-plugs being put in under a statutory power, and the Company being bound to maintain them under a penalty, the Company were only liable to the penalty, and not to an action for damages. Where an accident of this kind happened, there might be a number of claims; and it was highly desirable that what would be practically a test case should be tried in the High Court.

Baron Pollock, without calling on Counsel for the respondents, said he saw no ground for interfering with the discretion which he thought had been properly exercised by Mr. Justice Mathew. He did not desire to express any opinion on the points which would arise at the trial of the action; but the County Courts had now been established for many years; their jurisdiction had been extended from time to time; and they had long ceased to be a mere machinery for collecting debts. They afforded facilities for trying cases at less expense and inconvenience than in the High Court; the assistance of a jury could be obtained for deciding questions of fact; and the Judge would give all necessary directions on points of law. If the case were tried in the High Court at *Nisi Prius*, there would be just as much probability of an appeal; and he saw no reason why this case could not be properly and conveniently dealt with in the County Court. The motion would therefore be dismissed with costs.

Justice Manisty was of the same opinion.

(*Before Justices* Field *and* Cave.)

THE QUEEN *v.* MAYOR, ETC., OF RAMSGATE.—A QUESTION OF "COMMISSION."

This case raised important questions as to the right of a Town Council to pay their Surveyor for superintending the execution of a large scheme of drainage by commission on the contracts made by the Corporation with the contractors. Prior to 1884, Ramsgate was under the control of Improvement Commissioners. Their Surveyor was Mr. Barley, who received a salary of about £300, and was bound to give all his time to the duties of his office. The Commissioners had been in communication with eminent engineers for the execution of a large scheme of drainage; and Mr. Barley was required to report on the several schemes. In so doing, he suggested a scheme of his own; and the Commissioners adopted it, but did not carry it out, as in 1884 Ramsgate received a Charter of Incorporation, and the Commissioners' powers passed to the Council of the borough. On July 28, 1885, the following resolution was passed by the Council:—"Resolved, that the said Mr. Christopher Barley be appointed Engineer to the Corporation for carrying out the scheme for completing the drainage of the borough, and that he obtain the assistance of Mr. Baldwin Latham in carrying out the new outfall sewer; and that Mr. Barley be paid a commission for his services as follows—viz., Five per cent. in respect of the outfall sewer, to include Mr. Latham's charges for assistance, but such commission not to exceed £450; and three per cent. in respect of the remainder of the works, but not to exceed £330. That this resolution be subject to the Corporation entering into contracts for carrying out the work in each instance." In pursuance of this resolution, Mr. Barley undertook the work; and the Council on Feb. 2, 1886, resolved—"That £300 should be paid to the Surveyor on account of the commission allowed to him for the drainage work by the resolution passed by the Council on July 28 last." Similar resolutions were passed from time to time for paying the sums up to £780. Mr. Whiteley, a burgess of Ramsgate, brought an action against Mr. Barley for penalties under the 193rd section of the Public Health Act, 1875, because, being an officer of the Corporation, he had an interest in the contracts made. The plaintiff recovered £200; and this was affirmed in the Court of Appeal. A resolution was subsequently passed by the Council that the costs of defending this action by Mr. Barley should be paid out of the borough fund. These resolutions it was sought to quash, and on a previous occasion a rule had been granted calling upon the defendants to show cause against this being done.

Mr. Henn Collins, Q.C., and Mr. H. F. Dickens appeared for the defendants, and urged that the Court should not quash the orders, because the work had in fact been done. The price was reasonable; and the money might have been paid to Mr. Barley by way of "allowance."

Mr. Kemp, Q.C., and Mr. W. Chitty argued in support of the rule.

Mr. Justice Field, in giving judgment, referred to the facts, and said the rule must be made absolute to bring up the orders in question to be quashed. The vice in these resolutions, for paying Mr. Barley his commission on the contracts, was that it placed him in a position where his interests would be counter to those of his employers and the ratepayers. This was contrary to the express provisions of the Legislature. The Court of Appeal had already decided that Mr. Barley was "concerned or interested" in the contracts; and this seemed to conclude the matter. It was urged, however, by Mr. Henn Collins that the Corporation might have paid the money if they had granted it as an allowance under section 193 of the Municipal Corporations Act, 1882; and he cited authority to show that, where the payments were reasonable and just, even though they had not been authorized by due formalities, the Courts would not grant a *certiorari* to quash the orders for them. The Court had a discretion, it was true; and if the thing done was really harmless, and not contrary to the policy of the Act, they might refuse to grant the writ. The policy of the Act was wide-spreading, and became more important each day as further powers were given to local authorities. It was a dangerous thing to allow public bodies to go beyond their powers. As to the order for the payment of the costs of the defence of the action against Mr. Barley, that was quite improper. The rule must be made absolute, with costs.

Mr. Justice Cave was of the same opinion. He said that if the argument that the money might have been paid to Mr. Barley as an "allowance" were admitted, no one could tell where it would stop; and in each case it would be said that what had been done contrary to a statute might have been done legally in some other way, and ought therefore to be treated as properly done. The Court would not be exercising its discretion judicially if it refused the writ.

WEDNESDAY, MAY 1.

(*Before Justices* Mathew *and* Grantham.)

SOUTH METROPOLITAN GAS COMPANY *v.* NOAKES.

This was an appeal from the decision of the Magistrate at Southwark Police Court, who convicted the Company in two penalties of 40s. each, and £3 costs, for refusing to lay on gas to the premises of the respondent within a reasonable time after receiving his request for a supply.

Mr. Vaughan Williams, Q.C., and Mr. Tickell appeared in support of the appeal; Mr. Bucknill, Q.C., and Mr. Ogle for the respondent.

It appeared that in the first instance the Company were apprised by telegram that a supply of gas was required to the premises in question; and in the lower Court it was contended that this was sufficient notice. The Company failed to comply with the request within a reasonable time; and for this default were convicted. It was now urged, on their behalf, that under the Metropolis Gas Act, 1860, a period of seven days was allowed them in which to furnish a supply of gas after application had been made therefor. For the respondents however, it was argued that this provision was superseded by that contained in section 11 of the Metropolis Gas Act, 1871, which allows a "reasonable time" between the receipt of the notice and the provision of the supply. The whole of the arguments, therefore, turned upon the question of whether or not the Company were governed by the Act of 1860 or that of 1871.

Justice Mathew, in giving judgment, said that in his opinion the later Act was applicable to the Company, as shown by the very first clause. It had already been held that the Act of 1871 superseded the Act of 1860; and as the Court were bound to regard the authority of decided cases, they could not allow the appellants' contention. He must, therefore, come to the conclusion that the Magistrate was right, and that the conviction must be upheld.

Justice Grantham concurred.

The appeal was accordingly dismissed, with costs.

HALIFAX BOROUGH POLICE COURT.—Tuesday, April 30.

(*Before Messrs.* E. M. Wavell *and* J. Bairstow.)

THE ASSAULT UPON A GAS STOKER.

William Walton was to-day charged on remand with having in March last committed an aggravated assault upon John Robinson, a gas stoker, from York, who was employed at the Halifax Gas-Works during the recent strike (*ante*, p. 627). The case had been adjourned for several weeks in consequence of the prosecutor's illness.

The Town Clerk (Mr. Keighley Walton) appeared for the prosecution, and Mr. Storey defended.

The Town Clerk stated that on the evening of March 23, Robinson left the gas-works shortly before 9.30 in company with other men, and proceeded up Wade Street and along Northgate towards the bottom of the market. They were followed along Northgate by several men, among whom was the defendant; and, when the prosecutor reached the bottom of the market, he was violently assaulted, and knocked down by the prisoner, who ran away, leaving the man in an insensible state. Robinson was conveyed to the Infirmary, and remained unconscious for several days, and had not yet recovered.

Four men employed at the gas-works were called, and swore to the identity of the prisoner as the man who committed the assault.

Mr. Storey said he was not there to palliate the offence, nor to say one word in justification of such treatment as the prosecutor had received; but he was in a position to prove beyond the shadow of a doubt that the witnesses for the prosecution were entirely mistaken in the identity of Walton as the person who committed the assault.

Several witnesses were called in support of Mr. Storey's statement; and all testified to the fact that, from 7 o'clock to 10.30 on the night in question, the accused was not out of their sight.

The Bench, after retiring for some time, said there was not sufficient evidence as to the prisoner's identity; and they dismissed the case.

Derby Corporation Water Supply.—At the quarterly meeting of the Derby Town Council last Wednesday, Alderman Hobson moved that the expenditure upon permanent works of water supply during the past twelve months (£1250) be borrowed, and application be made to the Local Government Board for sanction thereto. This was agreed to.

Douglas (Isle of Man) Water Supply.—The Town Commissioners of Douglas (Isle of Man) have manifested a desire to possess the water-works in that popular holiday resort. The project has not, however, been favourably received by the residents; many of whom consider that, in the hands of the Commissioners, the undertaking would prove to be an additional burden upon, rather than a relief to, the ratepayers.

The London Commissioners of Sewers and their Artesian Well.—At the meeting of the Commissioners of Sewers of the City of London last Tuesday, the Clerk (Mr. H. Blake) reported the receipt of a letter from Mr. Hannay, Solicitor to Messrs. H. Hills and Co., the *quondam* contractors for the artesian well at Aldgate, requesting an interview with the Court on the subject of the rescission of the contract, as the stage had (stated the writer) been reached at which it would be more advantageous for his clients to complete than give up the construction of the well. The correspondence was referred to the Streets Committee undiscussed.

The Condition of the Eccup (Leeds) Reservoir.—The Quarterly Meeting of the Leeds County Borough Council was held last Wednesday. In the course of the proceedings, several references were made by the members to the condition of the Eccup reservoir; and the Chairman of the Water Committee (Alderman Woodhouse) made a brief statement respecting the matter. He said that there seemed to be considerable misapprehension in regard to the reservoir. If there was one Committee in the Corporation that had done more to take the public into its confidence than another, he thought the Water Committee might lay credit to itself for having by that means allayed public anxiety in time of trouble, without doing anything which it was not justified in doing. To go into the question of the leakage at Eccup was only going over ground that had been trodden many, many times. The reservoir was not finished until about three years ago, when it was filled by Mr. Filliter; and when full, it was found there was some leakage. They had bored seventy-nine holes, but probably rather more than half of them were bored before Mr. Filliter and Mr. Role ceased to be the Engineers. Mr. Hewson had since been carrying out the scheme of his predecessors, which he told the Committee he considered a good one. He did not know why there should be so much panic. The leakage had been reduced by more than a million gallons per day. When the reservoir was full, there was a larger leakage; but what was of more importance to them was that the water became slightly more discoloured. They decided then, at the suggestion of the Borough Engineer, to lower the reservoir as an experiment, and that was done, with the result that the discoloration became fainter. The question now was what they should do in the future. They had before them the report of the Borough Engineer; and, as the Council knew, the Committee met on the previous Friday, and came to the decision to consult Mr. George Hill, who had had a very considerable experience in reservoir construction. Mr. Hill was coming to Leeds immediately. It was not for him to say what was the cause of the leakage at this particular moment; to give an exact explanation of the subject was neither necessary nor possible.

Miscellaneous News.

ELECTRIC LIGHTING IN THE METROPOLIS.

BOARD OF TRADE INQUIRY.

(*Before Major* MARINDIN, C.M.G., R.E., *assisted by Captain* CARDEW.)

EIGHTH DAY—MONDAY, APRIL 15.

Mr. *J. Shoolbred*, examined by Mr. MOULTON, said he had for several years given great attention to the question of the supply of electric light. He had been consulted by local authorities on the subject; and had visited Bradford, Carlisle, Liverpool, Norwich, Richmond, and Scarborough. He had had to carry out installations for electrical supply; and was now carrying one out for the Corporation of Bradford. It was intended chiefly for a house supply. He had had to consider the two types of supply—the direct and the transformer systems; and had reported thereon to the Bradford Corporation. The Corporation visited several lighting stations in England—at Leamington, Kensington, and the Grosvenor Gallery—and they decided upon the direct-current low-pressure system. He had considered the question of the capital cost of the installation of the two systems, and reported to the Corporation; and, speaking from memory, he believed that the continuous direct-current system would cost £20,000, and the transformer £19,000. Taking into consideration the supply required by the Corporation for the public at Bradford, the direct system would be the better, having in view the facilities for storeage and lighting. It would be more economical to add storeage batteries to the system, because they could thereby relieve their generating plant. The direct supply from dynamos and from batteries was of such a nature that it could be extended according to the circumstances of the case.

In answer to Mr. PEMBER, witness said that before reporting for the Bradford Corporation, he had been laying down installations for electric lighting, for the last ten years, and had laid down some in London, in provincial towns, and a very important one at the Forth Bridge Works. One he had laid down in London was at Tate's large sugar works at the East End, which began with a few arc lamps, and had now 1000 incandescent lamps. That was all in one house. Before reporting for the Bradford Corporation, he had had no experience of the alternating system. The Corporation had on it good business men with some knowledge of electricity. At Leamington there were 2000 lights. The present intention for the supply at Bradford was limited; but it would be extended at a later date. It was very misleading to take installations by the number of lights. It was current that was supplied—he knew nothing of the number of lights for the customers. At Bradford it was intended to supply current for lighting and storeage. They would distribute so many ampères. Many customers preferred much larger lights than 16-candle; and it would be misleading to call the whole lighting 16 candles. Some persons would take 50 candle, or even 100, 200, or 300 candle light.

Mr. PEMBER: How many ampères do you intend to distribute?

Witness: The maximum supply from our machines is 1800—that is the rate of supply.

What voltage?—We have fixed 115 volts as the pressure for supply in the town.

Examination continued: Bradford being a manufacturing town with many industries, the installation would supply for motive power as well as for lighting. It was not lighting alone that was of value to Bradford; and as the installation would be required for other purposes, the Corporation preferred the direct system.

Cross-examined by Mr. CRIPPS: Witness said that the area proposed to be covered by the Bradford installation would be about half a mile by about a quarter of a mile.

Replying to Mr. SHIRESS WILL, witness stated that the distributing stations at Bradford were contradistinguished from the generating stations. He had seen the transformer at work supplying some houses with light from the Grosvenor Gallery; but he had not paid much attention to the system.

Mr. *W. H. Knight*, examined by Mr. MOULTON, said he had had experience as an electrical engineer in America. He was examiner in the electricity class in the American Patent Office, and afterwards went to the Brush-Swan Company as an expert, and with the Thomson-Houston Electric Company. He had been a contractor; and at present was Consulting Engineer to the London Central Subway Electric Railway Company. The tension used in the transformer system in America was 1000 volts for the primary current.

Mr. MOULTON: Do the insurance Companies in America permit the transformers to be used in the house?

Witness: No; they require them to be outside.

Under what circumstances are the transformer system generally used in America?—It has played a very important part in that country on account of the many scattered districts. It has been adopted in many places where there is no gas supply, and it has had a comparatively free field. But there has been no attempt to adopt it in places where the direct supply is ordinarily used. It is used in suburban and out-of-the-way districts, and in small towns.

What are the points of inferiority of the transformer system for supplying densely populated localities?—One fault is its unreliability and the danger of burning out the transformer. Another is its lack of economy, because it is often working on too small a lead. A third is the irregularity of the light. There is considerable variation in the candle power of each lamp. Some of the consumers have only a few lights, while others will have it too bright.

What is the efficiency practically obtained from the transformer?—About 50 per cent. It can be worked up to the highest efficiency of 95 per cent.; but as a matter of fact, it is not a general rule for persons to burn all their lights. And the efficiency is smaller in proportion to the fewness of lights.

What have you to say with regard to the safety of the system?—I think the system is safe enough with 1000 volts, if you take proper precautions, and if the primary circuit is properly guarded with safety devices. The primary circuit shock is a dangerous one. A friend of mine was prostrated with paralysis in getting a shock.

What shock was that?—A 1000 volts alternating main.

And therefore the safety consists in maintaining a perfect insulation of the primary from the secondary?—Yes; and that is not always obtained. The primary very often gets into the secondary.

You have heard of the proposed scheme of the London Electric Supply Company, and that they intend to have underground mains with a primary voltage of 1000, and a secondary of 2500. Will the joints of these mains be a source of weakness?—Yes.

What do you say with regard to the jointing of the underground mains with high voltage?—It is an extremely difficult feat to perform, even when the current is off. I have never known it done when the current is on.

Examination continued: The danger of leakage had always been a serious practical difficulty in the way of high voltage. He was not aware of any practical system having been invented for using alternating current for motive power. He had invented a system, and had seen others; but as a matter of practice, he had found it impossible to get any efficiency worth speaking of. Besides that the durability of the motor was extremely uncertain. They burnt out; and would not respond as the direct current system did. One company had had a very serious lesson as to the alternating current, having spent a great deal of money upon almost every conceivable shape of alternating motor—and some of them were most beautiful devices—but after devoting more than a year to the subject, they had to give it up; and they were now more extensively engaged in direct current motive power than any other company in America. They were doing the largest electric light business in the country, and also the largest motor business. That was the Thomson-Houston Company.

In reply to Mr. PEMBER, witness said with regard to insulation he did not state that the joints could not be made perfect.

Mr. CRIPPS: Who was the young gentleman friend of yours who was paralyzed?

Witness: It was Mr. Young, the son of Professor Young, of Pittsburg. That was above a year ago. He got his hands on to the two terminals at the switch-board. Witness continued that he had seen "burns-out" in Pittsburg about two years ago. He had been in factories, and seen so many score of "burns-out" of the transformers that it was quite a common event. It was his personal experience in America that the light was less regular in the transformer than in the direct system.

Mr. CRIPPS: Why is it that you say that?

Witness: It is more irregular in this way—A customer might have only a few lights on up to their full brilliancy; and then, when he turned on more lights, they would go down in candle power. Or to put it in another way, two consumers on the same circuit might have lights of two different degrees of candle power. One would have his lamp burning too brightly, whereas the other—perhaps only next door—would have it below the normal candle power. I have seen on the same primary circuit lights above the normal candle power, and others that were barely red hot.

What is the greatest percentage of irregularity in candle power that you have seen?—I should say about 50 per cent.

Mr. SHIRESS WILL: As to the transformers burning out, are there not different methods of constructing transformers?

Witness: Yes; but they are substantially alike.

You saw one burnt out?—Yes.

Were the low tension wires in the transformer properly insulated?—They were insulated in the usual way.

Does not the only liability of the transformer to burn out arise from the question of perfect or imperfect insulation between the high and the low tension wires? There is no such thing as a perfect insulation. In reply to further questions, witness said alternating dynamos in parallel had not been successfully worked in America, although that had been known to be a *desideratum*. Dynamos had been thrown into parallel, but had not been kept there. It was not possible with independent machines to carry out that system so as to work a network from many feeding points. The pressure in the American mains was 1000 volts, and that was considered safe; but the Americans were rather more reckless than the English. There certainly was danger; and it was not reduced by the system being properly fused.

Captain CARDEW: What are the house wires in America insulated with?

Witness: They are of two kinds.

Have they india-rubber insulation? No cotton insulation.

Were the muscles of your friend who took hold of the terminals, contracted and held to them?—Yes; he was pulled away by force. His hands were burnt to the bone.

He could not let go?—No; if the attendant had not pulled him away immediately, he would have been killed.

Mr. *J. Swinburne*, examined by Mr. R. S. WRIGHT, said that he was a Consulting Engineer, and had for some time been engaged in gas-works. He was not connected with either of the electric companies applying for Orders. Of course, if there were several Companies in the same district, there must be a greater aggregate cost, especially with regard to the mains; and this enhanced cost must eventually be borne by the consumers. The greater the number of competing companies, the greater the waste of capital. The effect upon the Chelsea Company would be disastrous if the London and Metropolitan Companies were allowed to enter the area as had been proposed. The London or the Metropolitan would choose all the most paying parts of the area; and thus would be enabled to undersell the Chelsea Company in their own district.

Mr. WRIGHT: And what effect would that have upon the prices charged by such a Company as the Chelsea?

Witness: A Company like the Chelsea, which was compelled to do lighting in the smaller streets, and not having the chance of entering the best part of Chelsea, would have to keep up its price to the maximum. It would be shut out of the chief residential parts.

In your judgment, as a man of experience in relation to gas as well as electricity, do you think there would be any want of effective competition in Chelsea? No, I do not. The question of electricity is not on the same footing as the question of gas, when the Gas Acts were passed, because electricity now has to compete with gas, which already has its mains everywhere; and it has also to compete with petroleum oil, the production of which has increased enormously recently, so that there is no question of monopoly, even if you give one electric light company a district to itself. Then, again, the waste products of gas have become so enormously valuable lately, that gas can be reduced in price very considerably, if necessary.

So that the competition of gas is, in your judgment, sufficient, so far as the interests of the public are concerned, in reference to the cost of electricity, and the price at which it is supplied?—Very much so, indeed.

Have you seen the alternating system at work in the United States?—Yes. I was in the States for six months in 1882; and also last year. It is generally used where the houses to be lighted are scattered; and in nearly every case I saw, overhead wires were used.

What is the reason of using overhead wires?—If allowed to do so, it is a splendid way of lighting towns which are scattered.

Why do they use overhead wires in America?—Because it is much cheaper. The expense of underground wires would be prohibitive in many parts of America. The condition of some of the streets is such that it would be almost impossible to lay them.

Is gas an effective competitor with electricity in America?—It is not so effective as in England, because in many of those towns there is no gas at all, and in other towns gas is very expensive. For instance, in my factory in Boston, or in the suburbs of Boston, gas costs 10*s.* per 1000 cubic feet, which, of course, is very much higher than the price of gas in England. It is a good deal higher in proportion, I think, than the extra price of coal.

I suppose you cannot give a figure for the corresponding price of the electric light in America by the alternating system?—No.

Cheaper a good deal than 10*s.* per 1000 feet for gas?—It would be cheaper than gas at that price. The witness added that he thought the direct system did rather more work than the alternating. The former was nearly always in use where the towns were not scattered places—for

instance, in New York and other populous places. The direct system was generally without the accumulators, because there was so much expense in obtaining them. The Brush Company was said to control the accumulators; and there was some dispute which the Companies had not yet fought out. The other Companies were rather afraid; and there were not many good accumulators. As to the comparative advantages of the direct and transformer systems for London, he said that the chief disadvantage of the alternating one was that more plant was required. Enough machinery was required to run the whole of the light which might be wanted at any time; and in London the maximum light was very much above the average, so that the available plant had to be very large. The alternating system had the advantage of distribution over a long distance. There were chances, too, of a breakdown. Electrical omnibuses and tramcars were making great strides; and when they came to be generally used, it would be a great advantage if they could be charged during the day, so as to equalize the work at the stations and so prevent waste.

Cross-examined by Mr. PEMBER, witness said that the failure of a dynamo at Deptford might cause the lights to go out at a theatre or large building, or at one of the sub-stations, for a few seconds whilst the switch was being set right. Of course, there was the danger of the man losing his head; and then no one could tell what would happen. It was a fact that the direct system was the one started in America by Mr. Edison; and he had two or three years' start of the alternating system. It was no doubt thoroughly well pushed by energetic men with ample capital.

Mr. PEMBER: And naturally such persons would lay hold of the most populous districts to start their works in, because they would be the most paying districts?

Witness: Yes; that refers to the early works started in 1881 and 1882.

So that the transformer system in America found itself two or three years behindhand; and the best paying districts had already been pretty well taken up?—To some extent they were; but at Boston there is a new plant of Edison's being put down now.

But the transformer system is overhauling the other?—I do not think so; it is making rapid strides.

If there is not a considerable change in the condition of things, can anyone hope that electric light will be able to compete in price with gas?—In price purely, I should think it is very doubtful.

You have been asked if you could put a figure so as to give the relative cost of electricity and gas, and you said "No"; but I believe you must double or treble at least the present price of gas in London before you can come to such an equation, must you not?—I think not on such a scale as this is. It would be higher, but not very much I am told, than the present price of gas.

I understand it compares with gas at 6s. per 1000 feet?—That is on the maximum price allowed here; but I think these maximum prices will come down.

I am glad to hear it. Of course, gas, for many reasons—I am now taking a domestic supply of gas—appeals to a perfectly different public to what the electric light, at all events at present, can appeal to?—It did a few years ago; but there is a very large change coming over the sale of gas.

I mean the poor, now, for instance, who want warmth, you know, as well as light from their illuminating material—they would never think of taking the electric light?—I think they would probably use petroleum, not gas.

And therefore, for all that section of the public, there is practically no competition, at present at all events, between electricity and gas?—No; not with the poor. The only thing the poor people want in many districts of London just now is small electric motors.

Now when we come to competition for those who would like to have electric light for lighting purposes in their houses, surely the competition is much more complete between two electric companies than it could be between an electric company and a gas company?—The competition is more keen, of course. There are three competitors instead of two.

I mean as compared with the competition between gas and electric light, the competition is much more complete between two electric lighting Companies who are competing in *pari materia*, so to speak?—Yes the competition is more keen between the two companies certainly.

In answer to Mr. CRIPPS, witness said that, as an engineer, he did not see any great difficulty in the underground mains. There was nothing experimental in the meaning of the word in the system of the Metropolitan Company.

Mr. *T. Callender*, examined by Mr. WRIGHT, said he was one of the Engineers of the Chelsea Electric Lighting Company. He had had great experience both in making and laying underground mains for electric lighting by different systems in Paddington and elsewhere. During the last six years, he had made cables for several hundred different installations, and had laid many. They were mostly for private installations. For fourteen years he had had special experience of asphalting and the difficulties of laying, opening, and restoring it. In London, and especially in the busy thoroughfares, there was considerable difficulty in laying anything, as nearly all the space was already occupied by the gas and water companies and the Post-Office tubes, which now ran nearly everywhere. Then there were the cellars, coal plates, and various outcroppings in connection with the houses which increased the difficulty of laying mains in towns.

Mr. WRIGHT: You have your choice between laying them under the footway, the kerb, or the roadway?

Witness: Yes. It is sometimes quite impossible to lay under the footway. In the first place there is no room. You cannot get a 6-inch pipe into a 2-inch space. The cellars cannot be touched except by consent. There is less difficulty in laying the mains under the kerbs there, although the space is limited. But we never lay them under the kerbs if we can help it. It is the worst place of any, for the kerbs are sure to be disturbed if anything is being done to either the roads or the pavements. We only go to the gutter as a last resort.

The space near the houses is always occupied by the Gas and Water Companies?—Yes. The gas and water pipes are frequently sufficiently low for our mains to be laid; but in spite of that, they will not allow us to lay our cables. In some streets it would be exceedingly difficult to run two sets of mains.

You cannot go quite close to the gas or water mains?—No; the Companies require a certain amount of free space. They always insist upon having sufficient free space to allow of their men comfortably getting their arms and hands down to do repairs.

In the course of cross-examination, witness said, as to the question of high pressure, that he would not be surprised at anything electricity was capable of doing. Probably it could be adapted to 10,000 volts pressure; but he would not like to try it at present. The greatest consumption of electricity at the West End was between 7 and 10 o'clock. In the City, it was a little earlier, so that it would be an advantage to one Company to have the supply of both. There was no difficulty in drawing cables out of the Callender-Webber case which was an improvement upon a patent the Company held. It was an easy job, so to speak, as all that was required was care and strength.

Mr. CRIPPS: How many lights are to be supplied from the distributing-mains laid down by the Chelsea Company?

Witness: About 1600 ampères. I have provided cables and mains for the working of 1600 ampères.

This work has been done under contract for the Chelsea Company?—Yes.

What has been the contract price of the 2¼ miles?—The maximum for the mains and everything is about £4500.

Mr. *J. S. Rayworth* was next examined, and said he was the Superintending Engineer of the Anglo-American Brush Electric Light Company; and he had had a great deal to do with the manufacture of apparatus for the alternating-current system. The Company had erected a station at Chelsea, the ultimate capacity of which would be the supply of thirteen stations, each with 2000 10-candle power lamps. When they reached that capacity, they would put in continuous-current transformers, fixing one at each battery station.

Mr. SHIRESS WILL: Do you contemplate using the batteries as a help at the time of the greatest amount of lighting or at all times?

Witness: In the first instance we propose to work entirely from the batteries. In the early part of the day we charge up our batteries—first one half, and then the other. Then in the evening, at the heaviest part of the lighting, we stop the engines and put both the batteries in parallel and work from the two, and that continues the whole night—the engines being stopped.

But still the time the batteries give you out light does not exceed seven hours?—That is so.

If you want ten hours' maximum light what then?—We do not contemplate it. It could scarcely be wanted except by a conspiracy on the part of all our consumers.

But supposing you have a very foggy day, from morning until twelve o'clock at night, so that you have the maximum requirement all the day long?—We are dealing with a residential district.

Yes; I will take a residential district. How are people to get on who depend upon your parallel batteries?—They are not likely to have dinner parties all the day long. As a rule there would be only a few lights throughout the house—there might be four out of forty. The maximum would not be used in any case.

Major-General *C. E. Webber*, Managing-Director of the Chelsea Electricity Supply Corporation, said his experience of telegraphs and wires was of comparatively ancient date. He was Divisional Engineer of the east and south-east of England from 1870 to 1879 under the Postmaster-General. That included part of the Metropolis. During that period, he had charge of the laying down of many miles of underground lines of telegraph wires, a number of which were in the City and other parts of London. His attention was then specially called to the importance of the systems of distribution, and particularly in connection with the distribution of electricity for lighting purposes. In 1883 he brought out a scheme for electric lighting for the north-east of Chelsea—the part of the compulsory Order under the Chelsea Act. It was examined and approved by Professor Ayrton, and was one of the first which received scientific approval. In the same year he (witness) patented a scheme with the view of using it in Chelsea if successful. It was a low-pressure scheme. In 1884 the present site for a central station was secured in Chelsea; and a Company, or syndicate, was formed; but the next year the proceedings were stayed for a time as he was called to Egypt. When he returned the same year, the statutory notices for a Provisional Order were issued; the Vestry gave their approval; and the Board of Trade granted an Order. The Company was formed in 1886. Previous to 1888, the public could not be induced to subscribe capital to carry on electric lighting undertakings under the provisions of the Act of 1882, because of the onerous terms of purchase. The two points in the Act objected to by their financial advisers were that there was a compulsory area in which they were obliged to put down their mains within a certain period, whether they knew they would have customers or not, and the compulsory clause for the purchase within a certain period. In 1887 the Company endeavoured to raise the capital of £30,000, which was considered ample to properly conduct their work. As to the area proposed to be dealt with by the Chelsea Company, he said that in the original district there were 220 houses, which would require an average of 27 lights at each house; making about 6000 lights in that district, and for which 12,000 fixed would have to be provided. In Kensington for which authority was now asked, there were 400 houses, of which about one-third would be consumers; and there would be about 3500 lamps in use, and about 7000 to be fixed. And in the area of St. George's, Belgravia, for which they were applying, there were 1536 houses; 512 estimated consumers; and 14,000 estimated lamps in use. The Company would spend £24,000 for the three parts of Chelsea for distribution; £12,000 for Kensington; and about £40,000 for the whole of St. George's, Belgravia. The central station which generated would cost £30,000, which, with other expenses, would bring the total cost to about £180,000. They were now only waiting for a Licence to light a portion of the Kensington area. Since the passing of the Act of 1888, it had been found practicable to obtain the capital necessary to do the work. The inhabitants of Egerton Gardens were very anxious to have the light; and a petition had been signed asking the Board of Trade that the recommendation of the Kensington Vestry to grant a Licence to the Chelsea Company might be carried out as soon as possible, so that they might have the light.

Cross-examined by Mr. WALLACE, witness said he moved in the matter of obtaining signatures to the petition. He believed the system adopted by the Chelsea Company would give satisfaction to the consumers, as it could be tested, and could be relied upon. The overhead system he did not call electric lighting. No one had devised an overhead system which would efficiently distribute electric light from house to house.

Mr. WALLACE: What do you estimate that each light in a house will produce gross per year, according to the charges you make.

Witness: That is to say, how much each lamp will earn taking our circumstances. Of that we have no experience at present in Chelsea. The experience of the earnings of lamps in all parts of Europe varies enormously, both as regards the time of year, and the conditions of the locality, and of the uses to which the buildings which are lighted are put; but I think that in domestic lighting in London each lamp will earn a gross revenue of from 15s. to 20s. a year.

That is about £40 a year per house?—No; less than that. It would be between £20 and £27.

And on the same kind of basis can you give me an approximate calculation of the figure of what the average net profit available for paying dividend would be?—With capital like that of the Chelsea Company that is in no way watered, the actual working cost including all charges—and calculating that we are supplying 10,000 lamps running the maximum number of hours—we ought to earn from 10 to 12 per cent. free for dividend.

Can you go to 17s. or 18s. as the gross revenue instead of 15s. to 20s.?—Yes; the thing is so much an estimate. Many persons put it at £1.

In answer to Mr. WRIGHT, witness said he highly approved of competition. His Company's system had been approved by the Board of Trade,

and their price was 2d. below the 10d. which the Order authorized. It was folly to think of having all the electric lighting mains in one tube; for it would be practically impossible to carry on maintenance and repairs.

NINTH DAY—TUESDAY, APRIL 16.

Major-General *Webber* was further cross-examined by Mr. GORDON with regard to the laying of cables, and the dealing with testing-boxes; and he stated that there was great difficulty in the laying of a number of mains in one conduit, especially in view of repairs. With regard to side connections of the mains, they would have to be cut when repairs were required. There was a physical difficulty in placing two sets of mains in one branch one over the other, so much so that practically no work could be carried on. If access was necessary at any time, one company would have to interfere with the works of the other.

Cross-examined by Mr. LOYD, witness said that he had not seen the letter which the Board of Trade had addressed to the London County Council, which pointed out that the inquiry was intended to decide whether concurrent powers should or should not be given to two or more companies within the same area.

Mr. LOYD: I will just read this to you: "Some of the local authorities in the Metropolis appear to be desirous to encourage competition, and are anxious to avoid the creation of a monopoly or *quasi*-monopoly for electric lighting, by giving any Company exclusive powers for any one area."

Witness: I have not read that letter.

I suppose when you first considered the question of getting powers in Chelsea, you arrived at the conclusion that there was a demand for electric light there?—No; I think I should say that I had not arrived at the conclusion that there was a demand there better than a potential demand.

You would not have chosen Chelsea unless you saw it was a place that wanted the electric light?—I chose Chelsea because I lived there, and because it was a fairly favourable area.

Cross-examination continued: He had no idea until he came to try and raise capital in 1886, that clause 27—the purchase clause—of the Act of 1882 would be regarded with such disfavour by the financial world as to strangle the companies. The generating plant of his Company would ultimately be put up on a scale to serve Belgravia, and such portion of South Kensington as was allotted to them. This would be supplied from one central station. The 13 stations with the 26,000 lights would be sufficent to light Belgravia and Chelsea and their portion of South Kensington, so far as they had estimated the electric lighting that would be required within the next two years. He did not think 100,000 lights for a square mile was at all a reasonable figure, although it had been given by some witnesses. In the City of London it was three times that.

Mr. LOYD: At any rate I may take it that you hope to light a portion of South Kensington, the whole of Belgravia, and the best part of Chelsea with 26,000 lights.

Witness: If you mean to replace every gas-light, I do not say that. I mean to effectually meet the demand within the first two years.

In cross-examination by Mr. WALLACE, witness stated that he had not, in the systems based on the capacity of the storeage stations, taken into consideration the question of street lighting. He had considered the amount of demand there would be in the short days of the winter, when fog was prevalent; and he was assured that for short intervals the batteries would sustain an extra output of at least 15 per cent.—quite sufficient to cover any short period of fogs.

Mr. WALLACE: What do you take as the length of the lighting that will be required on (say) the shortest day or thereabouts in December?

Witness: Seven or eight hours. The maximum five to six hours; and then there will be the lighting going on between seven and eight hours. We can charge at all times when the maximum discharge is not going on.

In reply to Mr. RUSSELL GRIFFITHS, witness said that he had had in the years 1870, 1871, and 1872, experience of laying electric lines in the City for telegraphic purposes; and he had exceptional difficulty to find room for them in some parts of the City.

After a short cross-examination by Mr. HITCHINS (on behalf of St. George's, Hanover Square) respecting the refusal of the Vestry to give their consent to the Order, and the relative merits of districting and side-to-side competition, witness was cross-examined by Mr. HEWITT (for South Kensington), and said that as to the concrete tubes which were to be used, they had placed one in a trench under the macadam in Chelsea; and although a steam-roller of 12½ tons had passed over them very shortly after under unfavourable circumstances, the tube was not broken. They would consolidate the ground underneath the tubes, and take all the risks of steam-rollers. He had offered to give the Vestry the power to purchase the undertaking in that district in 21 years, if the Company obtained the right to light the district.

Mr. MOULTON then opened the case for the Electrical Power Storeage Company, which, he said, applied for the lighting of two areas. The first one was for the parish of Paddington, and the other for the district composed of St. Martin's-in-the-Fields and the Strand. In the former case, his clients proposed to take the whole of the parish, and to have generating-stations fixed therein; so that it would be one complete installation coterminous with the parish. The system to be adopted was the direct supply system, supplemented by batteries, or batteries supplemented by direct supply, according to which was the more convenient. The Order was drawn upon the Model Order approved by the Board of Trade in 1883; and the compulsory area occupied nearly half of the parish which was not open land. They proposed to put down mains within substantially the whole of the streets of that area; and they specified every street in which they were willing to put them down. Although three years were mentioned as the limit of time, his clients were willing to shorten that time. For the northern part there was not likely to be an immediate demand for electric light. There was only about two-thirds of the parish which took gas; so that electric light would not be very likely to be required for some time. Their system of lighting the district afforded exceptional advantages. With regard to the financial position of the Company, he stated that they proposed to spend something like £30,000 in dealing with the compulsory area; and if any further capital was required, they would have no difficulty in obtaining it. They were prepared to carry out the Order as soon as it was obtained. The opposition to it only came from two quarters—the Vestry and the Metropolitan Lighting Company. The former had written a letter to the Company stating that they would give the preference to any company which would provide the light from stations within Paddington, so that the whole of the installations would be self-contained. The Company said they were in favour of this requirement; but since then the Vestry, for some reason or other, were inclined to oppose the Company. It had been suggested that they desired to light the area themselves. He declared that nothing could be better for the district than that immediate powers should be given to the Company; and the opposition of the Vestry ought not to influence the Board of Trade. He contended that they should give the Company the opportunity of doing a great service to the inhabitants of that parish. In regard to the other objection, he maintained that the Company was more likely to do its work more completely than the Metropolitan Lighting Company in that area; and therefore they ought to have the preference. Their terms were better, and afforded greater security for the work being thoroughly done, than the terms of the Metropolitan Company.

Major MARINDIN: Has the London Electric Supply Corporation withdrawn from Paddington.

Mr. MOULTON: Yes. With respect to the other area for which his clients applied, the Vestry of St. Martin's-in-the-Fields did not oppose any company going into their area, and therefore there were several companies competing in that one district. As the Electrical Power Storeage Company were not applying for a large area, and offered to do it more thoroughly than the other, they should have the preference. The terms of the Order were extremely favourable to the inhabitants. The compulsory area included every single street. The Electric Power Storeage Company were opposed in the Strand by the local authorities. An agreement had been entered into between the latter and the Metropolitan Lighting Company; but the Electrical Power Storeage Company were perfectly willing to take upon themselves all the obligations under that agreement, and to modify their Order accordingly, if they were allowed to do so. If those terms had been offered to them they would have been accepted; and they certainly expected that all companies would have been allowed to compete under the same terms. The area was very densely populated; and there was a great demand for electric light in the Strand, especially for the theatres. If there was any place where it was important that electric light should not be liable to the accident of instantaneous extinction from any cause, it was in a district where there were a number of theatres and other large buildings. If there was going to be a choice made between the alternating and the direct systems, the preference must fall on the latter. It would be most dangerous, especially at a time of popular excitement, if an accident should happen to the light, because it might lead to serious consequences. Under the direct system the danger of instantaneous extinction would not occur; and therefore they pressed upon the Board of Trade the necessity of having the direct supply system with batteries as being the only one which would fully satisfy the requirements of a district so peculiarly constituted as the Strand.

Mr. *J. I. Courtenay*, examined by Mr. Hunter, said he was the Managing-Director of the Electrical Power Storeage Company, Limited, which had 500 shareholders. The Company proposed to find capital for Orders for the Paddington and St. Martin's-in-the-Fields. Several of the large shareholders—including the Chairman of the Company (Sir Daniel Cooper), the Vice-Chairman (Mr. John S. Sellon), Mr. James Barclay, M.P., and other gentlemen—had agreed to find £60,000 as a minimum amount. Of this, £30,000 was to be allocated to Paddington; and £30,000 to St. Martin's and the Strand. As Managing-Director of the Company, he had made arrangements in various parts of Europe as to storeage. He believed he had concluded arrangements in most of the principal countries in Europe for the application of storeage batteries. He referred to Russia, Finland, and the Scandinavian countries where factories were just being completed; to France, Vienna, and Germany.

Mr. HUNTER: CAN you tell us the number of inhabited houses in Paddington?

Witness: It is rather short of 15,000.

And how many houses is gas supplied to?—Gas is supplied to 10,064 houses.

Mr. PEMBER: We may take it for granted that there are people in Paddington who want the electric light.

Mr. HUNTER: How many lights were supplied by the Gas Company to those houses?

Witness: The number of lights supplied by the Gas Company is 112,770, and the population is 115,000.

Cross-examined by Mr. HOBTIN, witness said that the number of houses in Paddington supplied with gas was 10,064. It was evident that there were a large number of houses, especially in the north of London, where gas was not taken.

Mr. HOBTIN: Are there not in the north part a number of very small houses that will not take gas in any event?

Witness: They do not take gas; and, of course, they would not take the electric light.

Is not the part of Paddington you have selected the very best?—We intended to select the best.

Do you think there is a house within the whole area that you have selected that does not take gas?—I cannot answer.

Mr. *F. King*, recalled, said, in answer to Mr. HUNTER, that the Company would in the first instance lay down plant sufficient for 10,000 10-candle lamps. The generating station would be on the banks of the canal. For those 10,000 10-candle lamps, £30,000 would amply suffice. It was the intention to make similar arrangements for the districts of St. Martin's and the Strand; and £30,000 would be quite sufficient for any demand that might arise within a year or two. The capital expenditure proposed by Professor Forbes would be equal to £2 4s. per 30-watt lamp fixed, or £3 6s. per 30-watt lamp running. Those figures compared with £1 12s. per lamp fixed for his (witness's) Company's system, and £2 8s. per lamp running.

Cross-examined by Mr. HOBTIN, witness said that the district of Paddington scheduled by the Company was straggling. It was an old-established district in which the inhabitants would probably be slow in adopting the electric light, on account of the change it made in their arrangement of decorations, &c., in the houses.

Mr. RUSSELL GRIFFITHS then addressed the Inspector on behalf of the Commissioners of Sewers of the City of London in opposition to the Orders of the London Electric Supply Corporation and the Metropolitan Electric Supply Company, Limited. He said that on behalf of the Commissioners he objected to Orders being granted to them for the area of the City of London, which was only part of a very large district which they claimed to light in the rest of the Metropolis. There were three main grounds on which he objected to these Orders. One was that the Commissioners of Sewers, who had been in existence since 1848, had hitherto practically controlled the public lighting of the City. They had also dealt with the private lighting, even for gas, and contracts were made for private lighting when gas was the first lighting medium. Being an active-minded and intelligent body of men, they were fully capable of conducting their own affairs and the lighting, as they had the power to do as the local authority under the 1882 Act. The 116th section of the Sewers Act of 1848, constituting the Commissioners, gave them express authority to enter into contracts with such gas companies and other persons as they might think fit, to supply gas, or to light the City by any other mode, and to cause lamps to be put up; and it also gave them express authority to impose such fines for neglect or non-performance of the contract as they should think needful for the well and sufficient lighting of the City. Coupled with that, they had the power to break up the streets within the City from time to time for any purpose; and they had full control over the streets. Of course, those powers were subject to Acts of Parliament, which gave the right to other Companies to come in and deal with those matters; and the Commissioners of Sewers were bound by such Acts, or Provisional Orders, as Parliament thought fit to make. But he claimed that they had sufficient

facilities given to them to contract for both public and private lighting; and that they were persons who, as shown by their acts hitherto, and by the way they had dealt with gas and electricity, were to be trusted to see that the public they represented—the very important public congregated in the City of London in great numbers during the day, and in smaller numbers during the night—had a lighting medium sufficient for all the purposes for which use could be found for it. The City of London was under the Electric Lighting Act of 1882; and if the Commissioners of Sewers wanted to light the City themselves, and supply private consumers, they must do it under the powers of that Act, which empowered them to borrow money for that very purpose. So that although they could agree to contract with persons for public lighting, and allow them to light privately, still, if the Commissioners wanted to be the lighting authority, they must come within the Act of Parliament.

Lord *Crawford* was at this stage recalled, and examined by Mr. PEMBER as to the £586,000 capital which the London Electric Supply Corporation had called up. This would, witness said, be required to finish the work it was proposed to carry on—viz., to complete the building, and put up the dynamos; to erect the generating plant which would enable them to generate simultaneously current for 250,000 lights; to carry that current from Deptford across the river at three points to the several distributing stations; and from them to distribute the current to the amount of the number of lights that it was proposed to commence their work with. This would include the distributing-mains, trunk mains, transformers, fuzes, switches, and everything. That estimate was passed when copper was at £85 per ton, and now they were buying it at £38. The Corporation had a surplus of £217,000 not yet called up.

Major MARINDIN: You have £130,000 in hand?

Witness: Yes; in hand to finish the present works.

Mr. RUSSELL GRIFFITHS: The capital of £586,000 is sufficient for the distribution of current for 250,000 lights?

Witness: That would be 150,000 simultaneously with 100,000 in reserve; and as soon as we get that, we shall have the two other dynamos at work also.

Cross-examined: With regard to the distributing-mains in the City, witness said he had been informed that there were roughly 50 miles of passages and streets in London that were lighted with gas. In the whole area under the specification of the Commissioners of Sewers for lighting the City, the number of gas-burners was 1547.

Mr. PEMBER: You have more capital to supply a greater number of lights than has been estimated for the City. You talk about reserving 30,000 for the City at night, and 100,000 during business hours.

Witness: We have spare capital to lay further mains if necessary.

You said the cost would be £1000 a mile, and 12s. 6d. a yard?—That is for a trunk main. The distributing-main would be about half that.

What does a distributing-main cost a mile?—For about 20,000 lights, I should say about £600 per mile.

And then there is the additional 12s. 6d. If then we get beyond the 250,000 lights, we can make a pretty fair calculation of about what the cost would be per mile for 40,000 lights more at that rate?—You can certainly do that provided you are in a thickly populated place, which the City is. If you have to go five miles for the 20,000 lights, of course that makes a difference.

Major MARINDIN: I suppose this £586,000 for distributing-mains is really an estimate; and from that you would calculate what it would average per 10,000 or 100,000 lights.

Witness: Yes.

Mr. RUSSELL GRIFFITHS resumed his address, and said that, as he understood Lord Crawford's explanation, there was a calculation as to the distribution of the capacity of light which would be generated in the first instance. There would be something like 150,000 lights supplied by engines, which had been described. But he (Mr. Griffiths) could only characterize them as engines which, working up to 1500-horse power, were proposed first of all to work at 5000-horse power; and then, as he understood, there was to be an engine attached to each shaft, and practically they would have an engine of 10,000-horse power. There had been some doubts expressed by witnesses as to the feasibility of such an engine working and generating electricity; and one witness said that, wherever an engine of above 3000-horse power was working in this way, there was a tendency for a flame from the armature to the magnet. Certainly they had had the extraordinary evidence that these engines of 10,000-horse power would do as much as 120 installations in America; so if the Americans had hitherto been a go-ahead people, they would have to hide their diminished heads in future in electricity. He submitted that the electrical knowledge possessed by Major Marindin and his assistant would tell them that that was an entirely unsafe power. It might be quite within the range of possibility. Electrical knowledge was increasing every day; but they should wish to have this light supplied to them with reasonable certainty, and from a place situated at a reasonable distance. Now as to the Deptford generating-station, or the "Electrical Beckton," as it had been called, this was certainly situated some distance from London; and, all the plant being under one roof, it practically formed one generating unit for the supply of electricity. This, he submitted, was a very great danger. A system like that, where there was no possibility of storeage, where it was running machinery, and all the machinery was kept in reserve as storeage, would be very unsafe for the City of London. It would not do to depend on their supply of electricity from that source. Trunk mains were in the first place to be carried up outside the railways. These were all in exposed positions; and the mere damage, the cutting, either by accident—even a railway accident—or by design, of these trunk mains would practically extinguish the whole of the electric light supplies from this particular Company. These were very cogent reasons why the City should dread to have its supply from this one Company. Their particular system could not be confidently recommended as more than an experiment. In detailing his objections to the alternating system of this Company, Mr. Griffiths especially alluded to the mains; and as to the joints and high tension of 10,000 volts, said that several witnesses had pointed out their great danger. They had had practical evidence from America, even with the small motors there used, of what they called those "burns-out," and that it was possible for the high tension to pass through the primary converter into the secondary—into the distributing-main, in fact—and even for the 2400 voltage which was passing along the distributing-mains to get into a house. The accident which happened to the gentleman at Pittsburg from the voltage of 1000 showed that there would be danger to the inhabitants of the house, and the persons who were using the electric light. The insulation was said to be such as would satisfy Mr. Preece, of the Post Office; but the outer sheaths of the mains that were produced had no insulation. That was one of the details which had not been sufficiently thought out to render it of practical use. The transformer system had only a paper existence; and experience was necessary to prove whether or not it was dangerous. As to the alternating system, no motor for electrical energy had yet been discovered for that system. The demand for motors had been shown to have been constantly increasing in Berlin and New York; and several witnesses had stated that there was a demand amongst the poor for electrical energy rather than electric light. But the Orders of both the London Corporation and the Metropolitan Company were confined to electric lighting. As regarded a great number of persons in London, if they were to have the streets disturbed with the constant taking up and putting down of the cables, they should most certainly be entitled to have such a system as could supply motive power as well as lighting. He desired to call attention to the fact that there was no storeage arranged for in this system. The reason why the London Company seemed to particularly want the area of the City was that they could supply the City with 100,000 lights during the day, and 300,000 during the night. And that seemed to be so because witness after witness had given evidence that it was the most wasteful thing under the sun to use engines when they were running light, when there was no load of light on them. He had carefully looked at the question of waste and loss; and Mr. Crompton was quite right in putting the hours of lighting in residential London in the winter for the maximum load at 7 o'clock, and from then a decrease. It was quite true that he said on April 10 that the maximum hours would be from 7 to 8, 8 to 9, and 9 to 10; but that applied only after April 10, and the months when the evenings were later. But practically that was what would be required in the City. The light in residential London began to be wanted from a little after 4 o'clock up to 7 o'clock, and then fell off; and this was explicable by the light in the shops being shut off. It was absolutely impossible for the Company which was going to commence with a supply of 140,000 lights to supply their own districts in the other area of the City of London as well. And it would be very unfair on the City that they should be used for that particular purpose. If they allowed this Order to go on as at present, practically they would be bound to this Company for 42 years. There was also an objection as to the life of the lamp, which was shorter where there was a variation of potential; and this was more likely to happen in the alternating system than if the light was direct and continuous, particularly where it was necessary in consequence of any accident to switch on to another dynamo. There was also a question as to the meterage. A witness had stated that there were as yet no reliable meters in the alternating system. As to the question of competition in the City, it was entirely inconvenient, and almost impossible. If these two Companies came into competition in the City, there must also be competition in some other form of electricity. It never could be allowed that only one form of electricity could be supplied. But the streets in the City were so full that it was absolutely impossible that more than one Company could come in one particular district. The plan proposed by the Commissioners of Sewers was to district the City into three divisions, to have a tender for each division, and to work each division perhaps by a different form of electricity, or as they liked, and then see in the present infantile state of electricity which would grow into the best child or man. That was a system which had been carried out by the Kensington Vestry. They had divided their area into three distinct districts, and allotted each district to a different company, or to a company producing electricity by a different method. Lord Crawford said he did not take a certain part of Kensington, because he was only offered a turnip field and a cemetery, for which there was not very much light required. But he (Mr. Griffiths) submitted that the local authority was the proper authority to deal with that matter; and the system of competition in the City must be entirely put out of the question. It would be for the Inspector of the Board of Trade to deal with either one of these Companies, and to allot them an area. The Metropolitan Company started with a capital of £500,000, of which they had spent, or were committed to spend, £351,000 for establishing six stations. It would be no hardship to that Company to be refused any part of the area of the City of London, for they had quite enough on their hands. They were only looking to the City as a possible appendage to their other stations. The main reason why they started their Company was to supply electric light to the West End; and these six stations would be quite sufficient to occupy them. In regard to these two particular Companies, the principal objection to their form of electric lighting was that it was purely experimental, and had never been carried out in this country in anything like the way in which it was now proposed to carry it out. Taking all considerations into account, this light might not answer the purposes which the promoters thought and expected it would answer; and if there was that possibility, the City ought not to be forced to accept it. The Provisional Orders were drawn with very great skill for the purposes of the Company, and not for the convenience of the public. Lord Crawford was practically right when he said they proposed to "creep" from eighteen centres. They would "creep;" and nobody could hasten their progress, because it was perfectly impossible to suppose that under these Orders the district would be entirely and satisfactorily lighted. If they come in under the Act, they ought to have an obligation cast upon them to do their works within a certain time, and over their own district. But under their Order they might say at any time within 42 years, or at any time within the life of the Order: "We may come in and complete these works, and compete with you." This would have the effect of stopping applications for the electric light, which they all thought was going to increase very much in demand, and also the supply of which was to increase and to become cheaper. With reference to the question of overhead wires, he pointed out that witnesses had said it would probably be necessary to have a system of overhead wires in the City in places where they could not get underground. It was true that both Companies had proposed this amendment: "Provided that nothing shall authorize the undertakers to place any electric line above ground, along, over, or across any street without the express consent of the local authority." But this was not a sufficient amendment to protect the local authorities generally, because it only provided that nothing in the Order should authorize the promoters to place any electric line above ground. It might be that, if under any Order they got into the heart of the City, or any populous place, then their overhead wires might not be under the Order but under agreement. He therefore suggested the following amendment:—"Provided that the undertakers shall not place any electric line above ground, along, over, or across any street in the area of supply included in this Order without the express consent of the local authority." The great difficulty as to overhead wires was that some persons who had allowed poles to be put up would require them to be taken down; and they were entirely at the mercy of individuals. Those were his main objections why neither of these Companies should have granted to them a Provisional Order including the City of London within its area. The City authorities were in no way inimical to electric lighting. What they wanted, and had always desired, was that, if they could get electric light under a contract from a Company, or under conditions which would not impair the usefulness, or impede the traffic of the City, they were quite willing to accept it; but they submitted that at present there was no security of that in either of these Provisional Orders; and it would be no hardship on either of these Companies to deny them access to the City. The form of the Order not being compulsory, and there being no amount of capital to be allocated to each district, it therefore would be unwise, and extremely detrimental to the future electric lighting of a compact

area like the City, to allow the alternating system solely to be introduced, because that system was to light over scattered districts. The proper course would be to allow the Commissioners of Sewers a certain time to see what arrangement they could make with the companies generally in their field. It had been put forward that competition would assist the public in lowering the price of the electric light. On the other hand, it was said it would not do so, because there would be so many additional miles of mains to lay, and, in addition to that, in the City it was practically impossible, because they could not lay them along the streets under satisfactory conditions. However, he gave those figures to show that districting, or allotting districts to companies, was really no disadvantage to the public in the sense in which the cheapness of the material was supplied. As to the position of electric lighting in the City, Mr. Griffiths said that in 1878 the question first came up. In 1871 the Jablockoff Company contracted with the Commissioners of Sewers to light Holborn Viaduct for six weeks, from Dec. 14 to Jan. 24. In 1878-9 the Commissioners spent a sum of £909 19s. for electric lighting; in 1880-1, £3111 12s. 5d.; 1881-2, £3104 12s. 8d.; 1882-3, £1786 1s. 3d.; 1883-4, £2312, 15s. 11d.; 1884-5, £1119 13s. 8d. There were various small sums that were the overplus of what was spent which had to be paid afterwards, amounting to about £175; making a total expenditure for seven years, or, one year not being given, in six years of £12,519 5s. 7d. So practically they had been spending at the rate of £2100 a year in electric lighting of the various thoroughfares. In the arrangements which were made from time to time with the companies—particularly the Edison Company in 1881 and 1882, which was under an arrangement with the Commissioners to light the Holborn Viaduct—they were entitled to use the subways of the Viaduct, and the Commissioners were to raise no objection to their supplying private consumers. Practically under the electric lighting supply there had been negotiations with the Commissioners from time to time, and one particularly of late with the Brush Company for supplying public lights, and also for allowing them to supply private lights. That arrangement with the Brush Company, in consequence of the 1882 Act being amended, did not come to anything; but the provisions which were part of the provisions of the agreement with the Brush Company had practically been embodied as the basis of the specifications for a contract for tenders for electric lighting in these three areas. The Commissioners were prepared to receive and to act upon tenders coming in from any companies, and there really would be no hardship either upon the citizens of London or upon these respective undertakers, even if they did not get their Provisional Orders this year, because practically, the citizens of London would be safe in the hands of the Commissioners, who were really trying to do the best they could for the constant future electric lighting of the City, and those Provisional Orders, however beneficial they might be to the companies who had promoted them, were not so beneficial to the public at large. Therefore upon those grounds he would ask the Inspector to report to the Board of Trade that there were special reasons for not including the area of the City of London in either of these Provisional Orders. The City of London desired to have some electric light, or rather electrical power, the energy of which would be equally useful for lighting or for motive force. After what he had heard of the conduct of the Commissioners, the Inspector would not think that they wished to put any stop upon the extension of electric lighting. Their wish was to foster it with a paternal hand, and not to allow conditions to be imposed upon them such as were proposed by these particular Orders.

The inquiry was again adjourned.

THE LIVERPOOL CITY COUNCIL AND ELECTRIC LIGHTING.

A Special Meeting of the Liverpool City Council was held last Wednesday to consider the following resolution:—"That the Council as the local authority under the Electric Lighting Acts, 1882 and 1888, consent to the Liverpool Electric Supply Company, Limited, making an application to the Board of Trade for a Provisional Order to supply electricity within certain defined districts of the city." Alderman J. Hughes moved the adoption of the resolution, and gave a brief outline of the negotiations which had resulted in the Watch Committee recommending the Council to approve of the proposed Order. He explained that the Watch Committee had carefully borne in mind the fact that protective clauses ought to be placed in their agreement with the Company, in the interests of the ratepayers. Under the draft agreement—which had been approved by the Company—it was provided that after 7 per cent. had been paid to the shareholders, the interest above and beyond the 7 per cent. should be divided—half to go to the Company, and half to the easement of the rates. At first the Committee thought 7 per cent. was rather high; but when they remembered that these gentlemen were investing considerable capital and incurring some risk, they must acknowledge it was a fair and reasonable rate of interest. The Committee had further obtained the right to examine and audit the accounts of the Company every year. It must not be supposed that the Provisional Order would confer an exclusive power upon the Electric Lighting Company. If an improvement took place within the next few years in the mode of electric lighting, and any other Company applied for similar powers, and thoroughly satisfied the Corporation as to the terms and conditions, it would be optional with the Council to grant them such powers. The fullest protection was obtained in the agreement for the streets of the city; and the Committee had stipulated that any alterations required in streets should be executed by the City Engineer, and the cost borne by the Company. Alderman Shallcross seconded the resolution, which was adopted.

Tarapaca Water Company, Limited.—The first annual general meeting of this Company was held last Tuesday at Winchester House, Old Broad Street—Mr. R. Harvey presiding. The circular calling the meeting stated that it would be necessary to adjourn it in order to present the accounts, and that in the meantime the Directors had declared two interim dividends, each at the rate of 6 per cent. per annum, for the quarters ended Dec. 31 and March 31 last. The Chairman stated that it had been found impossible to have the accounts to the end of December last prepared in readiness to be submitted at that meeting, in compliance with the Articles of Association; and he must therefore ask the shareholders to adjourn for three months, when a full statement of accounts to the close of the year would be placed before the shareholders. Meanwhile the works were progressing very satisfactorily. The water was actually on at Pozo de Almonte; and they would have commenced to deliver it in about a fortnight but for the accident of the loss of the steamship *Cotopaxi*, which had on board some air-valves for the Company. They were sending a telegram to their agent at Iquique, asking him to make some temporary arrangement by which they might immediately begin the delivery of water. The water was most abundant; and he thought the Company were in a very satisfactory position. In reply to questions, the Chairman stated that they could deliver 150,000 gallons of water daily. They had no difficulty about getting into Iquique, where they expected a large increase in the sale of water. A resolution was passed adjourning the meeting for the period above mentioned.

HALIFAX CORPORATION GAS SUPPLY.

The Recent Strike at the Works—The Gas Scandal.

The Quarterly Meeting of the Halifax Town Council was held on Wednesday last—the Mayor (Mr. Alderman James Booth) presiding. There was a full attendance of members; and much interest was manifested in the discussions on the above matters.

The Mayor said that he would like to make an explanation with regard to the recent strike at the gas-works, which he believed would interest not only the Council, but also the public. They would remember that about eighteen months ago Mr. Carr, the then Manager of the works, was allowed leave of absence. He was away from the works for about five months. During that period, the works were placed in charge of the foremen stokers, Crossley and Taylor; and he believed that, for some time previous to Mr. Carr going away, these men had control over engaging and dismissing the men employed at the works. He thought it would be very easily understood that, in these circumstances, it would be quite possible for these men to make use of their position for their own special purposes; and it had been openly stated more than once that men employed at the works had had to pay for their situations. A few weeks before Mr. Carr went to Australia, Crossley one morning saw that one of the gasholders was being suddenly exhausted; but he thought it would be all right until he had his breakfast. He got his breakfast, and on going back, found that the holder had collapsed; and it had cost the Committee £250 to put in repair. Subsequently Taylor, who was in charge, saw that there was a large and rapid leakage going on. The result was that this gasholder again collapsed; and it would cost the Corporation £1000 to put in repair. This expenditure had been caused purely and simply by the negligence and thorough incompetence of Taylor. The foremen had engaged the worst characters—men who had been in penal servitude—some of them having as many as 26 convictions against them; but they could not be surprised at this when Crossley himself—one of the foremen—had undergone a term of penal servitude.

Alderman Riley: How long since?

The Mayor said that if Alderman Riley wanted to know how long ago it was, he had the record there. Proceeding to allude to the recent strike, he stated that it could not have cost the Council much less than £1000. But the money had been well spent; for the works were now under proper control. The cost of the gas last month was less than in the corresponding period last year; and there was a good margin in favour of the present management.

The adoption of the minutes of the proceedings of the Gas Committee was then moved and seconded, whereupon

Alderman Riley observed that, with regard to the employment of the men at the gas-works, he had never engaged a man during the thirteen years he had been Chairman of the Committee. A statement had been made by the Mayor in public, to the effect that he (Alderman Riley) had been in the habit of sending letters to Mr. Carr recommending him to employ certain men; but for four years prior to Mr. Carr leaving the service of the Halifax Corporation, he (Alderman Riley) had never asked him to engage more than two men. He had never known Crossley and Taylor outside the gas-works, and did not think he had spoken to them while Chairman of the Committee, further than to say, "How do you do?" in the street. As to Crossley, he almost had the idea——

The Mayor: You must excuse me. We have not mentioned your name. There is no necessity for you to defend these men.

Alderman Riley: I do not think there is. You did not state to the Council that it was seventeen years (alluding to Crossley) since that offence was committed. I do think the Council were entitled to know that. The Mayor has been showing this man's photograph around the town and in his club; and I do say that for the Chief Magistrate——

The Mayor: If you please will you sit down? I will not allow it.

Alderman Riley (resuming his seat): It is only one more example of the interest you take in the working men of Halifax.

The Mayor: You have no right to make that remark.

The minutes were then approved.

The next business on the *agenda* paper was the consideration of resolutions of which notice had been given with regard to the recent gas scandal; and on the matter being introduced,

The Mayor asked Alderman Riley to retire, as the resolutions referred to him.

Alderman Riley: I am a member of this Council; and you have no right to ask me to go. I decline to go.

The Mayor having consulted with the Town Clerk, the point was not further pressed.

Alderman M. Booth then moved—"That the following resolutions adopted by the Council on the 3rd of October, 1888, be rescinded, namely:—'That if any member of the Council be named in the charges now about to be read by the Mayor, in the matter of the gas scandal, that such member be withdrawn from the Committees of the Council until such charges have been investigated.' 'That Mr. Alderman Riley be called upon to commence a civil action against Mr. Thomas King Fox for the purpose of having the charges made against him fully investigated, and that, in the event of his obtaining a verdict in his favour, he be indemnified against all costs, charges, and expenses incurred by him in such action.' And that in lieu thereof, Mr. Alderman Riley be appointed a member of the Water-Works and Baths Committee and the Watch and Bonding Warehouse Committee." Alderman Booth said he moved this resolution entirely of his own accord. Neither Alderman Riley nor any other member of the Council had urged him to place the notice on the *agenda* paper. In fact, not more than one or two members of the Council knew that he was about to propose it. Alderman Riley had for seven months been suspended from his position as a Town Councillor, because it had been charged against him that he had been guilty of malpractices. He (the speaker) had the testimony of the Town Clerk that neither himself, nor the Mayor, nor Alderman Ramsden knew anything whatever against Alderman Riley; he having never to their knowledge done anything of an irregular nature, or ever received any money or commission in his position as Chairman of the Gas Committee. He thought the time had arrived when Alderman Riley ought to be reinstated in his proper position on the Council. In his judgment, Alderman Riley had been sufficiently and more than sufficiently punished. Some months ago his name was the common talk of the town; and he was condemned everywhere and in every company. From the very first Alderman Riley had said that he had never received one penny directly or indirectly as a member of the Council, or as Chairman of the Gas Committee; and until something more than the bare statements made by Mr. Fox had been done, he (the speaker) would believe that Alderman Riley was innocent. So far as the indemnity was concerned, he had very little to say. Alderman Riley, for reasons best known to himself, had made no use of it. The question rested with him alone; and if he were satisfied to let the matter rest, he (Alderman Booth) had nothing to do but to leave it to his judgment.

Mr. W. Oswin seconded the motion.

Alderman Longbottom moved the following amendment—"That the consideration of the motion now made by Alderman Michael Booth for

rescinding certain resolutions adopted by the Council on the 3rd o October, 1888, be adjourned to the next meeting of the Council; and that the Committee appointed to investigate and report upon the charges made in respect of the maladministration of the gas-works be instructed to present their report to the Council at the next meeting, and particularly whether Mr. Alderman Riley has been guilty of any and what malpractices." He went at some length into the circumstances of the case, and said that what he wanted was that the Committee should report upon the character of the swindling which had been complained of, and particularly whether or not it affected Alderman Riley. If the Committee knew of the malpractices, why were they not exposed, and the guilty punished? This was what he and the public wanted to know. It was not enough to say that there had been 25,000 tons of coal purchased which might have been bought at 1s. 6d. a ton less than the price which had been given for it. It had been understood by the public that there had been some very serious misdemeanours on the part of Alderman Riley in connection with the scandal. He wished to know if the Committee had put their finger on anything; and he asked the Mayor, Alderman Ramsden, and the Town Clerk whether any one of them knew anything whatever against Alderman Riley with regard to the malpractices and maladministration of the gas-works—whether he had received the slightest benefit, directly or indirectly, to their knowledge, during the time he had been Chairman of the Gas Committee or serving in any other capacity whatever on the Council. He (Alderman Longbottom) had made these remarks in the interests of the public; and he urged that the report should be presented at the earliest possible moment, and then they would be able to decide whether or not they should rescind the first part of the resolution which had been passed.

Alderman D. Smith seconded the amendment.

Mr. Davis supported the amendment. He did think that the Committee should now present their report; and if they were of opinion that the charges made by Mr. Fox were false, then he felt that the Council should take some steps towards punishing him. He considered Alderman Riley ought to have taken proceedings to vindicate his character, and not have allowed such charges to hang over him so many months. Had he (Mr. Davis) been accused, he felt that he should have taken steps to vindicate his character even if he had to pay his last penny. He did not feel at all at liberty to give his adherence to Alderman Booth's proposition; but feeling that a report ought now to be made by the Committee, he had pleasure in supporting Alderman Longbottom's amendment.

Mr. J. Smith also urged that it was time a report was presented to the Council.

Mr. Oakes said he could not vote for Alderman Booth's resolution. Were the Council to pass it, it would simply stultify itself. The time had certainly come for a report from the Committee appointed to inquire into the matter.

Alderman Midgley also spoke in favour of the amendment. He thought that Mr. Davis's remarks seemed to contain very serious imputations against Alderman Riley. The irregularities at the gas-works applied to all the members of the Gas Committee; and it was not fair play to regard them as reflecting on Alderman Riley any more than on any other member of the Committee.

Mr. Davis disclaimed any such exclusive imputation.

The Mayor said he was prepared to say that he had not made a single statement that he was not thoroughly satisfied in his own mind was absolutely correct. Whatever statements he had made in public, he could verify. It was one thing to know or tell a thing; but another thing to prove it. A very great amount of information had come to his knowledge that he could not lay before the Council, simply because, if he were asked for his proof, the people who could furnish him with it were not prepared to come forward. This was his position; and it was a very unfortunate one. It was Mr. Fox who had made these charges, and not the Committee; and he was told that Alderman Riley, with the expenditure of about £50, could get full detailed particulars in such a way as the Council could not obtain them. Alderman Riley had power, after taking action against Mr. Fox, to compel him, by administering interrogatories, to disclose the details of the charges; but the Council had not this power. He (the Mayor) had gone so far as to see Mr. Fox's Solicitors; and he told them that the Committee had paid £100, but did not consider that they had got value for their money. They had obtained no information; only the charges had been defined. He informed them that the Committee were prepared to go further, and say that if the Solicitors would satisfy them that the charges could be legally proved, and that the Committee would get value for their money, they would pay any sum of money that the Solicitors required. Could anybody say anything fairer or plainer than this? He himself made the offer, and undertook to be responsible for the payment of the money. The Town Clerk had told the Council time after time that it was in the grasp of Alderman Riley to get the information from Mr. Fox; that he had no occasion to prosecute Mr. Fox further than in order to get the particulars; and that, if he commenced an action against Mr. Fox, he could please himself whether he went on with it or not, after getting the particulars. The Committee were quite prepared to bring before the Council full detailed statements of everything that they knew, so far as they had the power to do it legally. He was not going to put himself in the position of having an action for libel brought against him; and he repeated that he was prepared to substantiate everything that he had laid before the members of the Council.

Alderman Riley inquired if he might say a word or two.

The Mayor replied that they would gladly hear Alderman Riley's remarks.

Alderman Riley: I know Mr. Fox's antecedents——

The Town Clerk: If we are to get any information from Mr. Fox, do not abuse him now.

Alderman Riley, proceeding, said that he wanted to be friendly with the Committee, and give them every assistance in his power. He had nothing either to add to or detract from the statements made by him in the Council Chamber. He would give all the assistance that he could. He had nothing to fear in any shape or form; but he had peculiar reasons of his own for not proceeding against Mr. Fox. He repeated that he would give every assistance to the Mayor, Alderman Ramsden, and the Town Clerk to elicit all the information possible, and get to the bottom of this business, whatever it cost and whatever time he spent in the matter. What could he say more?

The Town Clerk: You cannot say more. Will you allow the Sub-Committee to issue a writ in your name?

Alderman Riley: No; and that is the peculiar reason I alluded to.

Alderman Booth, with the consent of his seconder, at this stage withdrew the original motion.

Alderman Longbottom's amendment therefore became the substantive motion; and it was suggested by the Town Clerk that he should add to its terms a clause giving the Committee power to incur all necessary expense.

Alderman Smith urged Alderman Longbottom to accept the suggestion. Let them, he said, do everything that was necessary to get to the bottom of this matter.

Alderman Longbottom said that he wished to do everything possible to get to the bottom of the matter; and if the Council were willing to give the Committee *carte blanche* with regard to expenditure, he was quite prepared to offer all the assistance in his power.

Mr. Oswin inquired whether it was worth while to proceed with the matter, if, as had been said, Mr. Fox was a man of straw.

The Town Clerk replied that Mr. Fox had offered to deposit £1000 as security.

Alderman Riley: Which he will not do.

The amendment was then put as a substantive motion with the addition suggested by the Town Clerk; and it was unanimously adopted.

Taylor, one of the late foremen at the gas-works, has written to the local papers asking for a suspension of judgment on the Mayor's statement, until he has replied to it. Meanwhile he says: "It is sufficient for me at present to say that I defy either the Mayor or any member of the Gas Committee to substantiate the serious charge made against me."

WIGAN CORPORATION GAS SUPPLY.

The Engineer's Annual Report.

The Gas Engineer of the Wigan Corporation (Mr. J. Timmins) has recently submitted to the Gas Committee his annual report on the extensions, renewals, and general working results of the gas undertaking for the year ending on the 25th of March last.

With regard to extensions, Mr. Timmins states that the central block of retort-benches has been completed, with the erection of the hydraulic mains, foul mains, ascension and other pipes, for 140 mouthpieces. The whole of this work has been carried out very successfully; and 56 mouthpieces brought into operation during the winter season. An extension of the western coke-stage has been made for the purpose of facilitating the loading of coke into carts direct from the retorts; and thus preventing the heavy breakage which would otherwise, and did under pre-existing conditions, accrue in material of so friable a nature. New and commodious offices, with laboratory, weigh-office, and weighbridge, have been erected during the year. This was rendered inevitable by the change from the old to the new retort-house; thus making it necessary that the principal entrance to the works should be from Darlington Street instead of Chapel Lane. The new offices have a commanding position, and consequently facilitate supervision over the whole of the works. A line of railway has been laid down the whole length, and on the south side of the retort-house, underneath the stage-floor, for the purpose of loading coke into waggons direct from the retorts. Under the heading of renewals, it is mentioned that two new engines, with rotary exhausters of the most modern type, have been put down in place of the old ones, which had become quite unfit for the work they had to do, in consequence partly of increased production, and partly from general dilapidation of their working parts. Each exhauster is capable of dealing with 80,000 cubic feet of gas per hour. This work has been executed, under contract, by Messrs. R. Dempster and Sons, Limited, of Elland, and has given every satisfaction. The whole of the re-arrangement of connections, &c., incidental to the change of exhausters, was accomplished by the staff at the works.

Having referred to the general repairs carried out during the past year, Mr. Timmins remarks that the only thing that remains to be done to make the works almost as perfect as it is possible to have a gas-works, is the arrangement of stores and workshops in close proximity to the offices. The works generally are now in a good and efficient condition, and compare favourably with the best and most modern works in the kingdom. Their capabilities at the present time (*i.e.*, without further expenditure on capital account) are as follows:—Total number of mouthpieces, 252; carbonizing power, 144 tons in 24 hours; gas-producing power, 1,612,000 cubic feet in 24 hours; present maximum make, 1,200,000 cubic feet, which represents a margin for increase of carbonizing power of about 36 tons of coal and cannel, equal to 412,000 cubic feet or 34·33 per cent. in the 24 hours. There is still room in the retort-house, and foundations are already laid, for other ten benches, comprising 140 mouthpieces, the carbonizing power of which will be 80 tons in the 24 hours; producing about 890,000 cubic feet of gas. The retort-house will then be capable of producing 2,508,000 cubic feet of gas in 24 hours, or 109 per cent. in excess of the present maximum make. The new furnaces and retorts have done excellent work; the make for the year averaging 11,295 cubic feet of gas per ton of coal and cannel carbonized—a result rarely equalled. About 3100 yards of new mains have been laid during the year, and 226 new services.

Proceeding to deal with the working of the year, Mr. Timmins says: The average illuminating power of the gas during the year has been 18·75 candles. At the beginning of the year there were on the register 5320 consumers; and at the end, 5398—being an increase of 78.

Appended is a comparative analysis of the working results for the two years ended on the 25th of March, 1888 and 1889 respectively, of which the following is a brief *résumé*:—

	Tons.	Cwt.
Coal and cannel carbonized, 1887 and 1888	22,210	16
" " 1888 and 1889	20,885	2
Less carbonized	1,325	14
Gas made, 1887-8	235,907,000 c. ft.	
" 1888-9	235,834,000 "	
Decrease on preceding year	73,000 c. ft.	

Thus there have been 1325 tons 14 cwt. less coal used, and only 73,000 cubic feet less gas produced. This is accounted for by the fact that 11,295 cubic feet of gas have been obtained per ton of coal carbonized, as against 10,621 cubic feet in the preceding year—

Gas sold, 1889	220,127,600 c. ft.
" 1888	216,116,100 "
Increase	4,011,500 c. ft.

There is, therefore, an increase in the consumption equal to 1·856 per cent., and a decrease in the production equal to 0·031 per cent. The quantity of coke made for sale is very much in excess of that in the preceding year. This is in a great measure owing to the improved method of heating the retorts. This result, and the decrease in the quantity of coke used in the manufacture, will, I know, prove very gratifying. Although 1325 tons less coal have been carbonized, 17,349 gallons more tar has been made than in the preceding year. The quantity of sulphate of ammonia made exceeds that of the preceding year by upwards of 2 lbs. per ton of coal carbonized. The mixture of coal and cannel used during the year represents about 1¾d. per ton in excess of last year. It will, however, be observed that the cost of gas per 1000 cubic feet has been less by about ¼d.—equal to 5¾d. per ton of coal carbonized. The cost of purification has been reduced from £126 12s. 5d. to £81 1s. 11d. The cost of repairs and maintenance has been increased by £446. This is accounted for in the painting of the gasholders, scrubbers, &c., and the repaving of the yard. A considerable amount of labour employed on

extraordinary renewals has also been charged to this account. The cost of fuel for steam-boilers has been reduced from £190 7s. 11d. to £124 12d. 2d. This is partly owing to the economy effected by the new engines, and partly to feeding the boilers with hot water instead of cold as was previously done. Bankers' interest and commission account is much in excess of last year; being £730 11s. 11d. as against £512 6s. This is an item over which I have no control. I regret that the consumption of gas has not increased to a greater extent. I am, however, very sanguine about our future prospects, especially if the boundary of the borough is extended as is anticipated.

In the next section of the report, Mr. Timmins refers to the profits of the past four years, 1885-8. During the year 1885 £6000, he says, appear to have been handed over for the relief of the rates, &c.; leaving an adverse balance in the accounts of £5134 1s. 2d. Otherwise the department would have shown a profit on that year's working of £865 18s. 10d. This adverse balance of £5134 1s. 2d. was reduced in the following year to £1561; thus showing a profit made on the year's working of £3573 1s. 2d. The following year—*i.e.*, the year ended on the 25th of March, 1888—saw this adverse balance cleared off, and a credit balance of £2144 17s. 8d. produced; thus showing a profit on the year's working of £3705 17s. 8d., notwithstanding the fact that revenue had been debited with more than £1000 on account of extraordinary renewals.

The year just ended shows a profit on the working of £6202 7s. 8d. This would have been considerably augmented had not revenue been debited with about £1500 on account of extraordinary renewals.

Mr. Timmins concludes his report by giving some statistics showing the proportion that the interest on "loans" and payment into "sinking fund" bears to the ton of coal carbonized. The charge on every ton of coal and cannel carbonized during the past year was equal to 2s. 4d., or 2¾d per 1000 cubic feet of gas above what it was in 1885. This—on 20,885 tons, is £2436 11s. 8d. The profits for 1888-9 have, nevertheless, been £5336 8s. 10d. in excess of those of 1885. The increased charge under this head, it is stated, is the result of the augmentation of capital account since 1885, by £54,000, which has been expended on covering over the canal "feeder," the new retort-house, boundary walls, the new gasholder and tank, new mains, &c.

At the Meeting of the Town Council last Wednesday—the MAYOR (Mr. W. Rogers) presiding—reference was made to the satisfactory result of the year's work of the gas undertaking.

Alderman SMITH, Chairman of the Gas Committee, said the result of the first year's working of the new retort-house was most gratifying to the Committee, as it must be to the Council and the ratepayers generally; and he was sanguine enough to believe that future years would be equally successful. Although they only showed a profit of £6202 on last year's working, they had actually made a clear profit of £8000; £1700 having been spent in extraordinary renewals, which would not be required in any future years. This item of £1700 might very properly have been placed to a suspense account, and wiped off in four or five years, or placed to capital. He thought, however, the Council would agree that the Committee had adopted the wisest course in dealing with the amount at once. He should be sadly disappointed if next year's working did not show a profit sufficient to enable them to hand £8000 over to the general district fund; and here he should like to remind the Council that they were supplying their customers with considerably better gas than they were bound to do by Act of Parliament—the average being 18·75 candles. He then proceeded to comment upon the various points in the Engineer's report, and concluded by moving the confirmation of the minutes.

Alderman ACKERLEY seconded the motion.

Mr. STUART acknowledged the great efforts which had been made in connection with the gas-works during the past twelve months. The report was very satisfactory. They were apparently going back to the old lines; and he sincerely trusted that it was only the beginning of better things. He wished, however, that the Chairman had laid down some distinctive lines of policy for the future. He thought these very large profits should be curbed somewhat, and that the Council had no right to obtain any more than would be considered a reasonable result out of the pockets of the gas consumers. What he hoped was that the Chairman of the Gas Committee would have expressed a desire that there might be a reduction in the price of gas, which would be the proper step to bring about a larger consumption. He was of opinion that the price of gas in Wigan was unreasonable, and that it would be wise to lower it. There were also other means by which the consumption might be increased. Every facility ought to be given to people to use gas. He knew it had been recommended by the Gas Manager in a former report that there should be no charge for putting gas into houses; and the Gas Committee should consider whether it would not be to their interest to do this. They had most unreasonable and old-fashioned charges in Wigan at present for connecting the gas-pipes. The double security insisted upon by the Corporation with regard to the meter-rent was a monstrous thing; and he thought they had gone past the days when such a thing was necessary. They should trade on the same terms as other people. He was not alone in this view of the question. There were other members of the Council who had advocated the same policy, and the Gas Engineer himself recommended it. This was perhaps not the time to settle the question, but it was the time for an expression of opinion; and on some future occasion he should take leave to submit a definite proposition on the subject.

Mr. JACKSON was in favour of getting rid of some of the other debts before they reduced the price of gas.

Alderman SMITH thought that if Mr. Stuart had attended the meetings of the Gas Committee, which he might and ought to have done, he would have known that everything he had mentioned had already been fully considered. The Committee were trying to make the profits higher, so as to reduce the price of gas; and their great desire was to increase the number of consumers. These questions had been under discussion. He thought it only right to state how much credit for the improved state of affairs was due to the Gas Engineer; and he could not sit down without recording his hearty approval of Mr. Timmins's work. The Corporation had certainly one of the best gas engineers in the country.

Mr. RICHARDS said the Engineer's report reflected the very highest credit on Mr. Timmins; and whatever other towns might have, they at Wigan had indeed a Manager who understood his work thoroughly.

The minutes were then passed.

Subsequently, on the Finance Committee's minutes being presented,

Mr. LAMB remarked that the transfer of £6000 from the gas account was a cheering factor. In 1885, £6000 was handed over from the same account to the relief of the rates; but this left an adverse balance of £5134, and the Gas Committee were not justified in transferring the sums they did. He had no such fear from the present transfer, because he believed the money had been honestly and fairly earned; and he concurred with the observation of the Gas Engineer when he stated he looked for a similar hopeful state of things in the future. He believed that he was justified in this hope, and that the works were carried on in an able manner by the Committee and Manager.

SALFORD CORPORATION GAS SUPPLY.

PROPOSED EXTENSION OF THE WORKS.

At the Quarterly Meeting of the Salford Borough County Council last Wednesday, Mr. H. Lord, in accordance with the recommendation of the General Gas Committee, moved that "the plans for the proposed reconstruction of the retort-house and contingent alterations at the Liverpool Street works, now submitted, be adopted, and that the works be carried out from time to time, as recommended in the Sub-Committee's report; the cost of the same to be paid out of the depreciation funds, at an estimated outlay of £40,000." He stated that the cause of the alteration was the unsafe condition of the retort-house, which was propped up with wood, and the old and inadequate condition of the retorts. The Committee proposed to reconstruct the building, and to introduce machinery on a more modern principle. The consumption of gas increased at such a rapid rate that it was imperative these steps should be taken to keep pace with the demand. It was expected that, with the proposed extensions, they would be able to produce an additional 28 per cent. of gas. Mr. Rycroft seconded the motion, to which Mr. W. Cook objected. Among the things contemplated, he observed, was the erection of costly hydraulic machinery and extensive excavations estimated to cost more than £2000. He contended that these were new works, and could not rightly be paid for out of depreciation fund, which could only be used for maintaining the works in good condition, and not for carrying out additions and improvements. Mr. Russell said that from his reading of the Act of Parliament, the Committee were quite right in seeking to use the depreciation funds in the manner proposed. Mr. Cook moved an amendment that the money should be taken from current account, except when it could be legitimately provided out of depreciation fund. The original motion, however, was adopted.

HEYWOOD CORPORATION GAS SUPPLY.

THE ANNUAL BALANCE-SHEET.—REDUCTION IN PRICE.

A Special Meeting of the Heywood Corporation Gas Committee, to which all the members of the Council were invited, was held on Wednesday, the 24th ult., to receive the annual balance-sheet of the gas undertaking.

Mr. LAWTON, the Chairman of the Committee, stated that the receipts from the sale of gas to private consumers and from public lighting amounted to £11,480 12s. 5d., against £11,341 11s. 1d. in 1887-8; whilst £330 1s. 8d. was received in connection with gas supplied for stoves and motive power, against £225 13s. 1d. in the preceding twelve months, and £48 19s. 7d. for the hire of stoves, as against £48 18s. 11d. Residuals produced £1727 0s. 11d., against £1488 11s. 11d.; showing a net total from gas and residuals of £13,537 15s., against £13,055 16s. 1d. On the other hand, the coal and cannel for the manufacture of gas cost (including cartage) £3456, against £3855—a decrease of £399; there was an increase of £11 for purifying material, wages, and sundries; an increase of £22 in the Manager's salary, men's wages, and carbonizing; and a decrease of £44 in repairs and maintenance. The total for manufacture was £5385, against £5796. Distribution cost £359, against £407; management, as before, £309; and general establishment expenses, £3, as against £20. Interest amounted to £1493, against £1563; searching for and repairing special leakages, £224, against £181; renewal of mains, £47, against £52; depreciation on stoves and meters, £93, against £51; annuities, £2437, against £2427; rents, rates, and taxes, £898, against £909; annuity sinking fund (one year's instalment), £331, as before; mortgage sinking fund, 1867 (one year's instalment), £153, as before; do., 1883, do., £50, as before; leaving a balance profit of £1740, or an increased profit this year over last of £949 after selling gas at 2d. per 1000 cubic feet less. They had paid £400 less for coal and cannel, and made a million cubic feet more gas; producing more gas from less coal. The leakage was about 3 million cubic feet less. Dealing next with the question of disposing of the profit, Mr. Lawton remarked that last year's profit of £791 was absorbed by placing £564 to a reserve fund, and paying off the amount expended on capital account during the current year. This year they proposed to wipe off the expenditure on capital account of £334 13s. 8d., and place £985 13s. 9d. to the reserve fund; making the £564 into £1500. This would reduce next year's interest considerably; and there would then be a disposable profit of £470 10s. 6d., which they proposed to hand over to the rates. It was too late to apply it to the reduction of this year's rate, because that was already made. The next question was, seeing that they had a fair profit, what should they do for the present year; and he might say they proposed to further reduce the price 3d. per 1000 cubic feet, bringing down the net price of gas supplied for lighting to 3s. 4d., and for gas-stoves and motive power to 2s. 11d. They expected during the year to have the sulphate plant at work; and if it came up to their expectations, and those of other people who had similar plant in use, they would make a considerable amount by the manufacture of sulphate.

The TOWN CLERK said that, as the Council knew, they had no working capital in the Gas Department, and a reserve fund of £5000 ought to be created as soon as possible.

Alderman HODGKINSON moved that the proposals of the Chairman be adopted.

Mr. HEYWOOD seconded the motion.

Alderman MARLOR asked what quantity of gas was used for motive power in Heywood.

The CHAIRMAN said that it was less than 2 million feet both for gas stoves and motive power.

Alderman MARLOR urged the Committee to consider whether they could not further reduce the price of gas for motive power as an encouragement for its use to drive small engines. If people could be encouraged to use gas instead of coal, there would be less smoke in the town, and the air would be purer. It would be better to sell gas at 2s. 9d. for motive power and stoves.

The MAYOR approved of the suggested disposal of the balance, with the exception of handing over money in reduction of the rates. He would rather favour the placing of the whole to the reserve. They had to face an advance in the price of coal, which was considerable; and they could not tell what it would be before the end of the year if they could not get rid of certain conditions in the contract. The reduction in the price of gas would also decrease their income; and they had to meet the competition of oil and electric light. It was important that they should reduce the capital account of the gas undertaking as much as possible. He moved that they hand over the whole of the balance to the reserve fund.

Mr. STAFFORD seconded the amendment. It was, he said, hardly fair to use money derived from the gas-works to reduce the rates, when some of the ratepayers would not burn gas at any price.

The TOWN CLERK sympathized with the Mayor; but he said that for the next six or seven years they had a considerable amount to pay each year towards the reduction of loans. They ought during those years to have a little ease. After that they would have to do as much as possible to reduce the capital account at the works, which was quite excessive for the size of the place.

Mr. BUCKLEY said there was a tacit understanding that the gas profits should go in liquidation of the loss on the water-works. He thought a reduction of capital to the amount of £935 was quite ample; and £470

was a small item for the risk and amount of advantage the gas consumers had from the ratepayers.

The TOWN CLERK said that since the gas-works were purchased 27 years ago, only about £1000 had been handed over to the rates.

The MAYOR observed that whatever understanding was given, there was not then the competition and the capital there was now. He wanted the gas produced as cheaply as other towns, and thought it unfair to take money from the gas undertaking until they had reduced the capital.

The motion was carried; three votes only being recorded for the amendment.

Mr. LAWSON then moved that the price of gas from March 25 be 4s. per 1000 cubic feet, with a discount of 8d., making the net price 3s. 4d. per 1000 feet; the price for stoves and motive power to be 2s. 11d. The reduction, he observed, would apply to outside consumers also.

The motion was carried.

BURSLEM CORPORATION GAS SUPPLY.

THE PAST YEAR'S WORKING.—INCREASE IN THE MANAGER'S SALARY.—REDUCTION IN PRICE.

At the Meeting of the Burslem Town Council last Wednesday—the MAYOR (Alderman T. F. Wood) in the chair—the report of Mr. H. Peaty, the Corporation Gas Engineer, as verified by the Accountant Clerk's statement, was presented. It showed that the profits for the financial year ending March 25 last amounted to £4607. Deducting the addition of £500 to the sinking fund, there was left £4107—an increase of £863, as compared with the preceding year. The Gas Committee recommended that £3300 of the balance should be applied in aid of the general district rate; that the price of gas from the 25th of March last (*i.e.*, in the June accounts) be reduced to 3s. per 1000 cubic feet, with an allowance of 3d. per 1000 cubic feet on payment as at present—making the net price 2s. 9d.; and that Mr. Peaty's application for an increase of salary be acceded to by the addition of £100 a year, to date from the 25th of March last.

Alderman MADDOCK in moving the adoption of the Gas Committee's minutes, congratulated the Council on the large balance of profit which had resulted from the year's working of the gas undertaking. A large number of the ratepayers did not, he said, interest themselves in the gas-works as they might do; and although they took advantage of the profits, which were used to reduce the other rates, did not return the compliment by becoming customers and consuming gas. In spite of the ratepayers using other illuminants, the competition must be kept up; and with this view the Committee recommended the price to be lowered by 3d. per 1000 cubic feet. Turning to the question of the application of Mr. Peaty for an advance of salary, he thought their Manager had behaved handsomely in not putting his application before them earlier, as two years ago it was for some reason or other put on one side. He had been in their service for 14 years at the same salary as that with which he commenced; and he (Alderman Maddock) left it to the Council to say whether the application for an advance was at all untimely. Their Manager had obtained for them most excellent results; and they ought by all means to reward him adequately for the labour and skill he had employed on their behalf.

Mr. J. ROBINSON seconded the motion.

Mr. EDWARDS expressed the opinion that the proposed addition was too large to be made at one stroke; and he moved, as an amendment, that it be £50 per annum.

Mr. BENNETT seconded the amendment.

Mr. BLOOR remarked that the improved results produced by the gas undertaking were not all attributable to the Manager. The Council should take into consideration the improved apparatus put up at the gas-works a short time ago.

Alderman LAWTON regretted that Mr. Bloor was the only member of the Gas Committee who was not present when it was decided to recommend the increase. In his opinion, the increase was most deserved. Under ordinary circumstances, an advance of £50 would be a handsome one; but in this instance the proposal was of no ordinary character, and he should vote for the motion as a matter of duty.

The amendment was then put, and lost by 5 votes to 13; the original motion being subsequently carried.

THE PROPOSED ACQUISITION OF THE MANSFIELD WATER-WORKS BY THE IMPROVEMENT COMMISSIONERS.—The question of the purchase of the Mansfield Water-Works by the Improvement Commissioners, we understand, has now been settled after much negotiation. A meeting of the Directors and a Committee appointed for the purpose by the Commissioners was held last Thursday, when the terms for the purchase of the concern were satisfactorily arranged.

EXTENSION OF GAS LIGHTING IN THE COLONIES.—We learn, from the Melbourne *Daily Telegraph* of March 20 last, that the town of Maldon was lighted with gas for the first time on the previous evening. The occasion was celebrated by a banquet given by Messrs. J. Coates and Co., the engineers and proprietors of the works, to the shire councillors and some of the leading merchants and bankers. Mr. Coates occupied the chair. All present congratulated the engineers on the great success of the undertaking. The town was brilliantly illuminated by various devices; and the streets were thronged with spectators.

ADDITIONAL CAPITAL FOR THE EAST WORCESTERSHIRE WATER COMPANY.—An extraordinary meeting of the shareholders of this Company was held last Thursday to consider the following resolution:—"That additional capital be raised by the issue of 1060 shares, at a discount of £5 per share, such shares to be offered in the first instance to the shareholders in the proportion of one share to five shares or any fractional part of five shares held on this 2nd of May, 1889; and that the Directors be and they are hereby empowered to allot, at such times and to such persons as they may determine, any portion of such shares not applied for in the above proportion within one month of this date, and on such terms as they may consider desirable, but at a discount of not more than £5 per share." The resolution having been moved by Mr. Bigwood, and seconded by the Chairman (Mr. C. P. Noel), Mr. Aston asked what amount of interest would be paid on the augmented capital. The Secretary replied that at the end of December there was a sufficient amount at the credit of the revenue account to have allowed the payment of a dividend at more than the rate of 1½ per cent. per annum; but the Directors did not feel justified, in face of the claims for extension of mains, in liberating that money for the purpose of paying dividend. If, however, the present resolution was adopted, the Company would be in a different position. The credit in question would be liberated; and he thought, looking at the amount of profit made during 1888, there was very little doubt that the present year would enable them to begin by declaring 1½ per cent. on the total capital. The interest required to pay that dividend on the present capital was £761 8s.; and though the profit for 1888 was £634, a sum of £129 8s. was paid away in interest on loans, which would be discharged by means of the new capital. The motion was carried.

SINGAPORE GAS COMPANY, LIMITED.

The Annual Ordinary General Meeting of this Company was held on Tuesday last at the Cannon Street Hotel, E.C.—Mr. R. S. FOREMAN in the chair.

The SECRETARY (Mr. Robert King) read the notice convening the meeting; and it was agreed to take as read the report and accounts for the half year ending Dec. 31, reference to which was made in the last number of the JOURNAL (p. 822).

The CHAIRMAN said that in the few remarks he had to make before moving the adoption of the report, he would, in the first place, more especially refer to the coal account, which showed an increase for the half year in the cost of coal carbonized of £534, or 5s. per ton above that of the previous half year. For the June half year the cost would be still further increased. This had been caused, as the shareholders were doubtless aware, by the rapid increase which had taken place in the rates of freight to the East within the last twelve months. The coal strike in Australia, which lasted nearly six months and was followed by a partial strike in some of the home collieries, also added to the difficulty of shipping coal upon advantageous terms. For some weeks past, however, the outward rates had shown a declining tendency. From the returns lately to hand, they found that the output of new shipping for the United Kingdom last year amounted to more than 900,000 tons, or nearly equal to the total of the two preceding years; and at the commencement of this year, the new shipping laid down or contracted for was on a still more extensive scale. At present a very keen competition existed in the carrying trade; and it would almost appear that the supply had already overtaken, if not exceeded, the trade requirements, and that in all probability lower rates of freight would rule for some time to come. With regard to other departments, the gas and meter rental remained almost the same as for the previous half year. The private rental exhibited some further reduction, caused entirely, as had been stated on former occasions, by the continued low selling price of kerosene. On the other hand, the public lighting showed considerable advance. Upwards of 100 additional new lamps had been ordered by the Municipal Commissioners, as stated in the report. Of these lamps, 38 were erected towards the end of the last half year; and the remainder would be lighted before the close of the current half year. The sale of residuals had been well sustained; and the prices contrasted favourably with recent half years. The small amount of actual arrears on the 31st of December, proved that no relaxation had taken place in keeping up the collections. The loss on exchange was, he said, lower, in consequence of the the smaller remittances from Singapore, occasioned by the heavy disbursements by the Manager on account of freight, for work done in connection with the new gasholder tank, and for other extensions. This would be shown more clearly when it was stated that during the half year two new purifiers had been erected, two beds of retorts had been rebuilt from the foundations upwards, and repairs had been done to four other benches. A considerable amount of work had also been carried out under the superintendence of their Manager (Mr. Batten), in excavating, and preparing the foundation for receiving the new gasholder tank. This was attended with much difficulty and heavy expense, in consequence of the treacherous nature of the subsoil, which necessitated the employment of powerful steam-pumping machinery to keep down the water. The earth from the excavation had been utilized in raising the level of the works; thus improving the Company's property, and saving expense in carting the surplus earth away. Taking up the matter from this point, the work of erecting the tank and holder had been carried on by the contractor, in (as the Manager reported) a very substantial and workmanlike manner, and without a hitch. By a letter from the Manager, dated the 24th of March, they learnt that the holder was then nearly completed, and the tank filled with water. Before moving the adoption of the report, he would be glad to answer any questions the shareholders might wish to put.

A SHAREHOLDER asked what was the quantity of coal carbonized last half year compared with the previous half, and whether there had been any reduction in the leakage.

Mr. B. GREEN inquired the price charged for gas to private consumers, and the prices realized for the residual products.

The CHAIRMAN replied that he had already said the returns from the residuals had been well kept up, and contrasted favourably with the two previous half years. Any further information could, however, be obtained by the shareholders at the office.

The SECRETARY said the quantity of coal carbonized was 1831 tons, compared with 1772 tons last half year. The leakage was 14 per cent. The Company had 35 miles of mains; and their district could not be compared with one where the services were very close together. They had a large district; and the services were often great distances apart. Under the circumstances, he did not regard 14 per cent. leakage as excessive.

Mr. H. W. SMITH said he was pleased to find that the position of the Company enabled the Directors to maintain their usual dividend. Taking into consideration the present condition of things, and the value of money, he thought they would all agree that a return of 7½ per cent. on their investment was not at all bad. With regard to the increased cost of the coal carbonized, he believed the Chairman intimated at the previous meeting that the shareholders might expect this would be so; and therefore they were not quite taken by surprise at the Chairman's announcement on this occasion. He was glad to learn that the new gasholder was nearly completed, as additional storeage room had been a long-felt want at Singapore; and the Directors had not liked to expend so large a sum of money until they were driven by absolute necessity. Where a manager was restricted from holder accommodation, it sometimes very largely increased the expenses of manufacture; so that it was not always true economy to put off providing additional storeage room. In conclusion, he expressed satisfaction with the profit and loss account.

The CHAIRMAN then moved the adoption of the report and accounts.

Mr. SMITH seconded the motion, which was unanimously carried.

The SECRETARY, replying to a question, said the price of petroleum at Singapore, when they last received information, was 1 dol. 51 cents per tin of 26 pints, or, say, 2½d. per pint.

Mr. T. A. GREEN thought gas would hold its own against petroleum at that price.

The CHAIRMAN observed that it was rather premature at present to speak of the results of the current half year; but he might say that the returns for the month of January, both in the public and private rental, had increased. Continuing, he moved the declaration of a dividend at the rate of 7½ per cent. per annum, less income-tax.

Mr. R. RICE seconded the motion, which was passed.

The retiring Directors, Messrs. A. Clarke and A. E. Stephenson, were re-elected on the motion of the CHAIRMAN, seconded respectively by Mr. T. A. GREENE and Mr. R. RICE.

On the motion of Mr. R. G. RICE, seconded by Mr. WALLER, Mr. W. T. Morrison, one of the retiring Auditors, was re-appointed.

The CHAIRMAN said that it was a matter of great regret not only to the Board, but he was sure to the shareholders also, that their other Auditor, Mr. Alfred Williams, did not offer himself for re-election. They had received a letter from Mr. H. W. Smith, in which he announced his intention

of offering himself as a candidate for the office. As far as the Board were concerned, they considered Mr. Smith would make a suitable successor to Mr. Williams; seeing that he was connected with the same profession, and had had great experience in all matters connected with gas accounts.

On the motion of Mr. R. G. Rice, seconded by Mr. B. Green, Mr. Smith was then elected to the vacant post.

Mr. Smith having briefly acknowledged the confidence reposed in him by the shareholders,

The Chairman said he thought a special vote of thanks should be accorded to Mr. Williams for his past services to the Company; and he proposed a resolution to that effect.

Mr. C. Newton seconded the motion, and it was unanimously agreed to.

Mr. Williams, in thanking the shareholders for the kind way in which they had received the motion, said he had more than served his "silver wedding" with the Company; and he now wanted to spare himself as much work as possible.

The usual votes of thanks were then passed to the Directors and the officers of the Company, and the proceedings terminated.

THE PUBLIC LIGHTING OF BRISTOL.

The Gas Examiner for the City of Bristol, Mr. Benjamin Kitt, issued last week his quarterly report—January to March—on the illuminating power, quality, and pressure of the gas supplied to the district. The illuminating power of the gas supplied to the public lamps was 14·91 candles; being 1·41 candles above the standard. The pressure was equal to the standard, and at no time below it. With regard to the chemical quality of the gas, it was free from sulphuretted hydrogen; but there were slight traces of ammonia. The average illuminating power during the quarter was as follows:—Maximum, 15·01 candles; minimum, 14·77 candles; and mean, 14·91 candles. The average pressure was: Highest, 2·4 inches; and lowest, 1·3 inches. During January last there were traces of ammonia in the gas. The number of public lamps in Bristol amounted at the close of the quarter to 5152; 43 new lamps having been erected during the three months. The consumption of gas amounted to 28,806,924 cubic feet; the public lamps consuming 28,671,624 cubic feet, and the offices and hospitals 135,300 cubic feet. The price of gas to the Urban Sanitary Authority was 2s. 2d. per 1000 cubic feet. The total cost to the city for the public lighting was £4013 2s. 4d.

In the course of the proceedings at the meeting of the Bristol Town Council, sitting as the Urban Sanitary Authority, last Tuesday, Alderman Baker called attention to the report of the Gas Examiner, which showed that there was a slight trace of ammonia in the gas. Great complaints, he said, were heard on all sides as to the supply and quality of the gas at Clifton, where the illuminating power should certainly be better than on the lower level. He trusted the matter would receive the serious and immediate consideration of the Authority. Mr. Levy thought that the public lighting also required attention; many of the lamps only having half the size of flame the city were entitled to. Mr. Wills confirmed what had been said in respect to the illuminating power of the gas. He had made a complaint in reference to this matter to the Gas Company; and the reply he received was that the illuminating power of the gas was much above that required of them. Alderman Naish remarked that Bristol was very early in the field in regard to gas lighting; and the illuminating power was fixed at 13½ candles, which was much lower than almost any other town or city at the present time. He believed the Gas Company admitted that the illuminating power might be increased; and when they went to Parliament, the Authority would endeavour to get it raised. The Company now gave a higher illuminating power than could be legally demanded; but still the light was not adequate.

GAS AND METER TESTING IN CANADA.

According to the fourteenth report of the Commissioner of Inland Revenue for Canada (Mr. E. Miall), dealing with the inspection of weights, measures, and gas during the year ending June 30, 1888, a copy of which has lately reached us, the total amount received in that period for the inspection of gas and gas-meters was $6946·65, as compared with $6654·40 during the year 1886-7. The total expenses were $20,894·98, as against $17,710·11 in the preceding twelve months. The following are the proportions of receipts and expenditure assigned to the various districts:—

	Receipts. Dols.		Expenditure. Dols.
Ontario	3980·90	..	6959·43
Quebec	2078·75	..	4104·74
New Brunswick	510.25	..	1707·51
Nova Scotia	337·00	..	2168·54
Prince Edward Island	52·75	..	283·44
Manitoba	71·50	..	894·00
British Columbia	65·50	..	413·00
	6946·65	..	15,030·66
General expenses, printing, &c.	—	..	4,864·32
			20,894·98

The gas was tested for illuminating power in 36 places; but in only 8 was it found to be below the standard (16 candles). The following are the places and the number of times the gas was at fault:—Belleville, 6; Chatham (N.B.), 14; Hamilton, 1; Ottawa, 44; St. John, 1; St. Thomas, 1; Three Rivers, 12; Toronto, 2. It appears that some of these places have been delinquents on previous occasions, as Mr. Miall calls the attention of the Minister of Inland Revenue (to whom his report is addressed) to the fact that in the year 1886-7, 56 per cent. of the tests at Ottawa were below the standard; while the present report shows them to have risen to 66 per cent. The previous record for Three Rivers was 40 per cent. to the bad; the one now under notice is 23—an improvement. At Chatham, in 1886-7, the failures were 62 per cent.; in the past year they were 58 per cent. The Commissioner says that in order to put a stop to such utter disregard of the law as has been shown by some of the suppliers of gas, an amendment of the Gas Inspection Act is necessary, in order that penalties may be inflicted for neglect to keep the illuminating power of the gas up to the legal standard. With regard to purity, the only tests regularly carried out for sulphur and ammonia were in Ottawa, Toronto, Montreal, Quebec, St. John, and Halifax. In the two first-named places, these impurities were never in excess of the quantity allowed by law; and this was the case also in Quebec. However, sulphur was 17 times in excess in Montreal, 4 times in Halifax, and once in St. John, which was also on one occasion at fault in regard to ammonia—the gas in the other places being quite free therefrom. Of all the tests made for sulphuretted hydrogen, at only one place—Fredericton—was it detected; and there it was present in the gas on three occasions. The details of the inspection of gas-meters show that 7945 were presented last year for verification, and 158 were rejected, against 7588 presented and 179 rejected in the year 1886-7. Of the 7945 presented, 377 were wet and 7568 dry. On testing, 1502 were found to be correct, 1449 fast, and 4836 slow. On re-verification after the first rejection, 15 were found correct, 7 fast, and 19 slow. Of the 158 meters rejected, 27 were unsound, 83 fast, and 48 slow. The Commissioner closes his report by giving the names of the towns in which inspection standards and apparatus were at its date about to be fitted up, and those which were desirous of possessing them. During the year reported upon, the gas inspection offices at a large number of places were visited by Mr. Johnstone, the Chief Inspector of the Standards Branch, who found everything working satisfactorily, alike to producers and consumers.

GLASGOW CORPORATION WATER SUPPLY.

The Progress of the New Works at Loch Katrine.

A recent issue of the *Builder* contained the following particulars as to the progress of the new works which are being carried out by the Glasgow Corporation at Loch Katrine for duplicating the water conduit to the city. Our contemporary says that the calculations of the Corporation Engineers, brought to a practical bearing a short time ago, indicate the approximate space required for completing the tunnelling operations; though possibly, under an exceptionally fortunate train of attendant circumstances, the great boring may be accomplished some short distance of time within the limit. On a fairly generous yet by no means extravagant estimate, however, three years from the present time has been recognized as the earliest likely date of completion. The subterranean cutting is not continuous, but, owing to the configuration of the country traversed, falls into four main sections, according as it is necessary to pierce through the more or less elevated ridges and mountain spurs of Perthshire and Stirlingshire, which separate the loch from the Kelvin watershed, on the northern flank of which, eight miles from Glasgow, the tunnelling terminates. As the city is served from this point by gravitation, the bore has all the way to maintain a level approximating to that of the parent loch; and the downward gradient is therefore sufficient only to induce the requisite celerity of flow. Four valleys of inferior levels intervene at pretty regular intervals; and these depressions are all passed, partly on the syphoning principle in closed metal piping, and partly by carrying the channel on piers.

Leaving the loch, tunnelling begins at once by a cut nearly 1¼ miles long, freeing the work from the loftier ridges enclosing the natural mountain basin. This portion is about to be attacked. The Duchray tunnel follows after an interval, and then the Kelty; the contract comprising the latter by this time showing a very satisfactory commencement. Most progress has been made with the Mugdock tunnel, the section which lies nearest to Glasgow, and brings the aqueduct out upon the Kelvin watershed and into immediate touch with the great artificial service reservoirs, Mugdock and Craigmaddie—the former in use since 1859, and the latter now under process of construction. Of this tunnel there remains uncut little more than 400 yards; the total length being upwards of 1¼ miles.

To the Engineers of the Corporation, the construction of the second service reservoir, much smaller though it is, as reckoned on the financial consideration, has been fraught with by far the greater load of anxiety. Ever since the start was made a few years ago, and until recently, the progress attained has been but of the most laggard kind. Engineering difficulties have not been wanting; but the first allocation of the contract was not a fortunate one, and hence sprang the greater portion of the vexatious tardiness so long characteristic of the operations. Ultimately the contract had to undergo a very radical rearrangement; the outcome being that it fell into the hands of a new firm. Since this change was effected, the progress made manifest has been, on the whole, satisfactory to the Engineers. The making of the huge embankment works (the heaviest of the sort in the country) is proving a very arduous undertaking; and even on the most sanguine estimate, the new reservoir, which is contiguous to the old, cannot be ready for service for a year or two. Raising the level of Loch Katrine by a few additional feet, and the laying down of an increased number of supply-pipes between the reservoirs and the city, form the remaining portions of the work necessitated by the scheme of extension. Only a very small proportion of these terminal sections has yet been entered upon. It is now fully recognized that the works for a wholesale enlargement of the Loch Katrine possibilities of supply have not been taken in hand a day too soon. The city and the surrounding districts with which it is conjoined, have much more than overtaken the margin of inflow and storeage of water deemed in 1856 abundantly sufficient over a stretch of the future at that time hardly regarded as measurable; and it is thought that if the approaching summer should prove a dry one, the population even thus early will be rather straitened.

The Proposed Electric Lighting of Folkestone.—About a fortnight ago the Folkestone Town Council, it may be remembered, after much discussion, passed a resolution adopting a scheme of electric lighting for the western part of the town, providing the Gas Company would consent to discontinue the public lighting of that district if found necessary—certainly a somewhat singular resolution to emanate from a body of practical men. As was generally anticipated, the Directors of the Gas Company have refused to comply with the proposal; and have intimated that they will not assent to any modification of, or departure from, the existing arrangement.

The Bolton Corporation and Water Gas.—At the meeting of the Bolton Town Council last Wednesday, Mr. Healy directed the attention of the Chairman of the Gas Committee to the water-gas operations which are now assuming such large proportions. He said he knew that the Gas Committees of other Corporations were looking into the matter. Taking the cheapest ordinary gas produced at 1s. 10d. per 1000 cubic feet and the dearest at 7s. 6d., if water gas for all purposes could be manufactured for 4d. per 1000 cubic feet, it represented not merely a great change, but a revolution. He did not know how far the present plant might be adaptable, but he thought it was a serious question for the Gas Committee to consider. Alderman Dobson said it had been his intention to mention the matter. There was no doubt all boroughs in the kingdom which had property in gas-works would require to pay special attention to what was going on, particularly as he knew that large consumers of gas had their eyes fixed on the experiments which had been made; and which had now passed beyond the experimental stage. He saw no reason why the plant of the gas-works should not be adaptable for the new method of gas manufacture. In any case, people who could get gas for 4d. per 1000 cubic feet were not likely to go on paying the prices which the Corporation were obliged to charge at present. The Gas Committee would be wise to take the matter in time; and thus prevent private individuals putting down their own installations. Alderman Miles expressed his personal obligations to Mr. Healy and Alderman Dobson for referring to the important matter of water gas. He said he had been surprised at the results which had been claimed for it; and he noted that the papers and periodicals connected with the gas industry seemed sceptical on the matter. He should certainly give the subject his most serious attention.

NOTES FROM SCOTLAND.

(FROM OUR EDINBURGH CORRESPONDENT.)

EDINBURGH, *Saturday*.

As time goes by, the interest which at first attached to the doings of the Edinburgh and Leith Gas Commissioners is found to subside. Their meeting on Monday was tame, when compared with some they have held; yet two or three items of interest were before them. The first was a minute of the Works Committee, to the following effect:—"Reporting that Committee considered Engineers' explanations as to their returns for February last, as compared with the previous year, quite satisfactory." Regarding this, Mr. Colston made the complaint that the explanations should have been put before them. These were not forthcoming, however; the Commissioners who formally raised the question doubtless now feeling that the less said about the matter the better; but I am able to state that the explanations which were offered by the Engineers to the Committee were very much what I foreshadowed in my "Notes" on March 19. The question of hiring out cooking-stoves came up on the following recommendation by the Works Committee:—"That the Commissioners might, as an experiment, hire out cooking-stoves, the value thereof not to be under £2; the rent to be 10 per cent. on the price and on the net cost of fitting up; the hirer to undertake to keep the stove in order, and to pay rent for not less than one year, and for the exact time over twelve months that the stove might be retained, such rent to be collected at the same time as the ordinary gas accounts. Hirers desiring to purchase their stoves, to be allowed a deduction of two-thirds of the rent paid therefor from the price of the stoves and net cost of fitting up." To this Mr. Kinloch Anderson started the extraordinary objection that they might possibly create a greater demand for gas than their present works, whose powers of production were limited, could supply. Their space for extending being also restricted, he thought it would be unwise at this stage to introduce the system of gas cooking, or encouraging the use of these stoves when the possibility was that it might hasten the time when they would require to increase their works. Bailie Archibald assured Mr. Anderson that there was no fear at all. The principal object was to increase the use of gas in summer. They were just now spending £16,000 which, upon the report of their Engineer, would produce three or four million cubic feet of gas per day; so that they really needed customers. Bailie Walcot pointed out that the amount of money they were receiving just now for gas supplied to work gas-engines was about £3000 per annum. Mr. Kinloch Anderson said they should hold themselves in reserve for the natural demand for lighting purposes, which was largely increasing. Mr. Colston remarked that electric light was certain to be put into large buildings; but that gas would never be without its uses was to be found in the very many applications of it in use. Mr. Anderson said that Mr. Colston having made that admission, he would withdraw his opposition entirely, and the matter was remitted to the Works Committee, with power to carry the recommendation into effect. The reports by the Engineers again gave rise to some "twaddle." They showed that during the past month the output at the Edinburgh works was 78,133,000 cubic feet, and at the Leith works 34,114,000 cubic feet—an increase over the output in the corresponding month of last year of 1,425,000 cubic feet in Edinburgh, and 1,138,000 cubic feet in Leith. Bailie Walcot said he was struck with this difference, that in the Edinburgh works the coal cost about 20 per cent. less than last year; while in the Leith works the decrease was only about 10 per cent. Bailie Archibald explained that they entered into a cheaper contract for coal for the Edinburgh works. Mr. Smith Clark observed that there was a decrease in the Edinburgh works for both wages and lime, and in Leith there was an increase in both; and it was explained to him that they recently advanced the wages of the Leith workmen. The salary of Mr. J. M'G. Jack, the Clerk to the Commissioners, was fixed at £300 per annum; and he was awarded an honorarium of £150 for extra services in connection with the transfer of the works.

The water-gas mania has hitherto not affected this district, not even—unless it be quietly—the Stock Exchange; but it was at one time well-known here. Mr. Mitchell, the Engineer of the Edinburgh works informs me that, in excavating in connection with the improvements at his works, he this week came upon and removed some of the masonry which long ago formed part of the plant for making water gas by White's process. One is tempted to say that if there be anything in the water-gas schemes which are at present before the community, how unwise the Edinburgh Gas Company must surely have been to give up its manufacture. They paid 10 per cent. for 50 years upon coal gas; with water gas at the prices advertised, can anyone say what their dividend might not have been? But then it must not be forgotten that the profitable nature of the schemes with which the public are being tickled has yet to be proved, and that the Edinburgh Company were too well managed to give up anything which was likely to increase their receipts. The Elgin Gas Commissioners have caught the infection. On Monday night they instructed Mr. W. Taylor, their Gas Manager, to report to them upon this new gas, which can be made for 4d. per 1000 cubic feet. I hope Mr. Taylor may be able to keep them right.

People are apt to be dazzled by the electric light in more ways than one. Edinburgh is at present erecting, through the munificence of Andrew Carnegie, of Pittsburg, a fine building for the housing of a public library; and as becomes a concern of such magnitude, the managers could think of nothing less than the electric light to illuminate it. Gas-fittings are to be introduced, "in case of a breakdown of the electric light;" and gas is to be used in the basement flats during the day, but at night everything is to be in full blaze with electric lighting. So far, good; but what of the cost? Sir Thomas Clark, who was Lord Provost at the time the scheme was started, assured the citizens that the public rate to be levied for the support of the library would be only ½d. per £1. But it is now found that the £50,000 gift of Mr. Carnegie is likely to be entirely swallowed up by the building, and that the full rate of 1d. per £1 will require to be imposed. Sir Thomas is very much concerned at this; and at a meeting of the Committee of Management, this week, he gave vent to his feelings in the expression that £400 per year for the maintenance of the electric light was far beyond expectation, and he was quite astounded at it. So am I, too, seeing that the same money would provide 2,400,000 cubic feet of gas, which is far more than would be required to light the building.

The financial year of the Dundee Gas Commission closed on the 30th ult.; and they are able to report a most substantial advance. The amount of gas distributed during the year was 406,341,800 cubic feet—being 16,000,000 feet above the estimated quantity at the beginning of the year; and an increase, compared with the preceding year, of 21,244,900 cubic feet. This is the largest amount of gas that has ever been supplied in any year. The price last year was reduced from 3s. 10d. to 3s. 8d. per 1000 cubic feet—a reduction which is equal on the gross consumption to £3386. Notwithstanding this, the large increase in consumption has raised the revenue from gas about £400 above last year—the total gas-rental being nearly £67,000. Treasurer Nicoll will be justified in making a further reduction in price. The Commission entered into contracts for 35,000 tons of coal, at a price much about the same as last year. A saving is expected upon carriage; the railway rates being estimated at slightly less than they have been

The Innerleithen Gas Company have paid a dividend for the past year at the rate of 7½ per cent., and reduced the price of gas from 5s. 5d. to 5s. per 1000 cubic feet.

The Portobello Gas Company have resolved to expend several thousand pounds in extending their gas-works, of which the principal feature will be a telescopic gasholder of a capacity of 160,000 cubic feet.

The new duplicate Lintrathen main of the Dundee Water Commissioners was opened on Wednesday by the wife of Lord Provost Hunter, in a manner befitting the importance of the undertaking. The pipe, as is well known, has been laid to overcome the difficulties which have arisen in consequence of the frequent bursts—one every six weeks on an average—which have occurred in the original main. The new pipe extends only through the valley of the Isla, from Lintrathen Loch to Pitnappie—a distance of 9½ miles. It has cost £50,000, of which the pipe contract, which was executed by Messrs. D. Y. Stewart and Co., of Glasgow, amounted to £33,332. This extension to the works of the Commission raises its capital to £810,000, of which the first line of pipe between Lintrathen and Pitnappie cost £98,000. By the present arrangement, 8 million gallons per day will be delivered in Dundee, which, it is estimated, will serve for ten or twelve years; and then if necessary the supply can be raised to 17 million gallons per day, by continuing the second line of pipe from Pitnappie to Dundee. This is calculated to cost £17,000. The work of planning and seeing the new pipe laid was entrusted to the Engineer to the Commission (Mr. J. Watson, M. Inst. C.E.); and he deservedly received the compliments of the company at the opening ceremony for the efficient way in which he has executed it, and, what is more pleasing, all within the estimate. At a luncheon which took place at the loch, Mr. Watson, acknowledging the toast of his health, said that the new main was, so to speak, a chain ten miles in length, each pipe-length of which formed a link, which would move longitudinally, vertically, and transversely; great care being taken that no iron should abut on iron. He was of opinion that ample provision had been made for any contraction or expansion arising through differences of the temperature. Another feature of difference was that, while the old line was composed of cast iron only, the new line was a compound line formed of cast iron steel hooped—a combination from which he confidently anticipated favourable results. He might mention that, as the Dundee Water Commission were the first to lay down a line of solid steel pipes for water purposes, they had also, as far as he knew, been the first to use steel in combination with cast iron.

(FROM OUR GLASGOW CORRESPONDENT.)

GLASGOW, *Saturday*.

Having, by the votes of the shareholders at the recent meeting, secured the "ways and means" to enable them to proceed with such extensions and improvements of the works in their keeping as may seem most urgent, the Directors of the Partick, Hillhead, and Maryhill Gas Company have lost no time in determining what they will first put their hands to. Acting under the advice of their Manager (Mr. L. Monk), who has done them yeoman's service during the past two or three years, they have resolved on making a great addition to the gas-producing capacity of the works. Forthwith, close upon 100 new retorts will be erected. They are to be on a new plan; the "settings" employed being on an improved method, and the furnaces so arranged that the regenerative system of firing the retorts will be of the simplest kind consistent with efficiency. When a sufficiently large surplus producing power has been obtained by the Directors, it is not unlikely, I think, that they will "go in" and bid for business considerably beyond their present area of supply.

At the usual monthly meeting of the Dumfries Gas Commissioners held on Thursday, the Gas Committee reported the arrangements they had made for purchasing coal for the following season's consumption. The purchases which it had been agreed to make were: Niddrie coal, 1000 tons at 20s. 3d. per ton; Douglas coal, 500 tons at 19s. per ton; Hall Craig coal, 500 tons at 15s. 9d. per ton; Muirkirk No. 2 coal, 500 tons, at 13s. 9d.; North Motherwell coal, 1000 tons at 13s. per ton; Home Farm coal, 1000 tons at 11s. 6d. per ton; Lanemark coal, 1000 tons at 10s. per ton; Sanquhar coal, 1000 tons at 9s. 9d. per ton—total, 6500 tons; the whole cost being £4437 10s. Provost Scott, in submitting the Committee's minutes for approval, stated that in the case of the coal contracts some of the prices were higher than those paid last year for the same coals, but that on the average the price was less.

At the monthly meeting of Hamilton Town Council on Thursday, the Gas Committee submitted the balance-sheet for the year, and recommended that the price of gas be reduced from 3s. 4d. to 2s. 11d. per 1000 cubic feet as from March 15 last. They also recommended that £2500 of loans be paid off. Provost Archibald moved the adoption of the minutes, and in doing so remarked that the important part was the balance-sheet which had been laid on the table to be remitted to the Auditor. In the meantime, he observed, as it stood, that there had been a profit during the year of £1865. During the same period there had been paid £1000 to the depreciation account. The state of the finances was so far satisfactory that the Committee had recommended a reduction in the price of gas, which would take exactly one-eighth off the charge; and as, at the balance on March 14 they had £2575 in bank, they were satisfied that they could spare the money so as to allow £2500 of their debts to be paid off. As £250 had been paid off during the course of the year, this would make the total sum wiped off £2750. That would in the future make, roughly speaking, a saving of interest of £100 a year. But for the large loss of gas that had gone on during the whole of the year, and the breaking of pipes, mainly attributable to the mineral workings, in all probability their financial return would have been even more satisfactory; for, in addition to the loss of gas, there was a constant expenditure for workmen's wages and material in the repair of the breakages. There was no reason to expect, however, that the expenditure on this account would be any less in the future. Meanwhile, they were glad to be able to recommend a substantial reduction in the price of gas. In answer to Bailie Tainsh, the Provost said the debt now standing against the works would amount to about £20,000. The report was adopted.

A fortnight ago I made mention of the Falkirk Joint-Stock Gas Company having secured ground adjoining their works at Grahamston for the erection of a new gasholder. I can now supplement that statement by saying that the ground is at present occupied by granaries, which are to be taken down, and that the new holder will be erected on the site. It is to be 92 feet in diameter, by 20 ft. 6 in. deep, and to be capable of holding 240,000 cubic feet of gas.

On the Glasgow Stock Exchange last Monday, business was done in the Partick, Hillhead, and Maryhill Gas Company's shares at 92s. 6d. per share. The price asked by sellers at the close in the afternoon was 94s. 6d. per share. On the following day the Glasgow Corporation 9 per cent. gas annuities changed hands at £281 10s. per share.

A meeting of the Helensburgh Police Commissioners was held to-day, at which it was resolved to expend £1500 additional on the water-works extension scheme, so that the works might be made more complete. This will bring the sum expended on the works up to something like £5800.

The strained relationship between the Kilmarnock Town Council and

the Water Company, which is of some years' standing, seems not to be getting any nearer to a satisfactory conclusion. An attempt has recently been made to get the Lord Advocate—the chief law officer in Scotland—to take some action; but he declines to interfere in the matter.

The Glasgow pig-iron market has apparently been "halting between two opinions" this week. On Monday the opening price for Scotch warrant iron was 44s. 0½d. per ton cash; and the close yesterday was 44s. per ton. A considerable quantity of iron was brought forward in the earlier part of the week for realization, and could only find purchasers at receding prices, down to 43s. 6d. An improvement then set in; and higher prices were obtained. Apart from the purely speculative branch of the trade, business is in a highly satisfactory position all round.

In the coal trade the tone is still good in all the branches; and prices keep very firm.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *May* 4.

Sulphate of Ammonia.—Contrary to the predictions emanating from certain quarters, that a decline in values early in May was inevitable, the aspect of the market is in no way altered; and although some cheap quotations have been reported f.o.b. Hull, prices generally have been firmly maintained. Higher prices have, in fact, been paid for spot parcels on this coast. To-day the market is so well cleared of parcels for prompt and near delivery, that, even with an ordinary demand, present rates must be maintained, while if the necessities of Continental and Colonial buyers become more urgent, it is not at all unlikely that quotations will take a sharp upward turn. It is irrelevant to quote the low rates of nitrate as a deterring influence to the advance or even the maintenance of sulphate prices. The stocks of the latter are exceptionally low; the production is rapidly falling off; and a probably very large summer demand has to be satisfied. The nitrate market for future delivery is dearer at the principal consuming ports—indicating that a continuance of low values of this commodity is discredited; and although the figures of stocks and quantity afloat show an excess over last year, the season will in the present instance be prolonged beyond the usual limit, and the consumption, for beet crops especially, is estimated to increase considerably. Continental buyers begin to recognize the position, for they accord very full prices (over £12 in some instances) for sulphate for summer delivery; and similar prices have been paid occasionally until March, 1890. But there are very few sellers for such distant delivery.

LONDON, *May* 4.

Tar Products.—Crude carbolic is in great request for shipment; but makers are pretty freely sold, and the price is likely to be higher. Holders of anthracene are very firm in their notions of value; and although little business is doing, sales have been effected at the prices quoted below. There is plenty of inquiry for benzol; but distillers are now on their small make, and being well sold are somewhat indifferent. Pitch is in excellent demand. Heavy shipments are being made, and the price is firm. Quoted prices are: Tar, 20s. to 25s. per ton. Benzol, 90 per cent., 3s. 3d. per gallon; 50 per cent., 2s. 3d. per gallon. Toluol, 1s. 5d. per gallon. Solvent naphtha, 1s. 3d. per gallon. Crude naphtha (30 per cent.), 1s. 1d. per gallon. Light oil, 3½d. per gallon. Creosote, 2¼d. per gallon. Pitch, 22s. 6d. per ton. Carbolic acid (crude), 3s. 9d. per gallon. Cresylic acid, 10d. per gallon. Tar salts, 17s. 6d. per ton. Anthracene (30 per cent.), "A" quality, 1s. 3½d. per unit according to quality; "B," 1s. 1d.

Ammonia Products.—The sulphate market has been exceedingly disappointing, as, with the earlier season, and the better agricultural prospects, it was expected that a large home demand would have been made on it. Undoubtedly the extraordinary collapse in nitrate has something to do with the weaker condition of sulphate; but it is more in theory than in fact—the sulphate "bears" using the weak position of nitrate to depress sulphate. Varying quotations are made to-day for sulphate, ranging from £11 10s. to £11 17s. 6d. per ton; but there are no buyers at anything like the latter figure. Prices: Gas liquor (5° Twaddell, 8s. per ton, with a rise or fall of 1s. 6d. per degree. Sulphate of ammonia, £11 10s. to £11 17s. 6d. per ton. Liquor ammonia, 2d. per lb. Carbonate of ammonia, from 3d. to 3½d. per lb. Muriate of ammonia, brown, £19 per ton; white, £23 15s. Sal-ammoniac, £30 to £32 per ton.

THE ENGINEERING TRADES AND THE PROPOSED PRIVATE BILLS COMMISSION.—The Engineering Trades Section Committee of the London Chamber of Commerce, as representing a body who are largely interested in public and private works of various kinds, had under consideration at their last meeting, held under the presidency of Mr. E. H. Carbutt, the Bill for establishing a Commission to examine and report on Private Bills in Parliament, and for other matters relating thereto, which has been prepared and brought in by Mr. Craig-Sellar. After a long discussion, the Committee came to the conclusion that the Bill is a step in the right direction, and is likely to bring about a great improvement in the method of conducting Private Bill Legislation, provided certain modifications are introduced, more particularly in the direction of some appeal being allowed to another tribunal in the event of objection being taken to any Private Bill by the Commissioners, who will practically have power to determine as to how far any project submitted for the sanction of Parliament is expedient or otherwise. Our readers are aware that the Government have also introduced a Bill having a similar object to that of Mr. Craig-Sellar and his colleagues; the only difference in the two being that while the private measure applies to the whole kingdom (England, Scotland, and Ireland) the Government Bill is intended for Scotland only. The Committee will further consider both Bills.

THE SUPPLY OF GAS TO HORWICH.—On Wednesday last, at the meeting of the Horwich Local Board, Colonel Ainsworth said he had seen Alderman Miles, Chairman of the Bolton Corporation Gas Committee, with reference to providing gas-lamps where they did not at present exist, and Alderman Miles pressed upon him the strong wish of the Corporation to meet the Horwich Board in a liberal and prompt manner. Then came the question whether it would not be advisable, in considering the question of putting in service-pipes, to lay gas-mains at once. Alderman Miles pointed out that there were not enough inhabitants willing to take gas to make the venture pay; to which he (the speaker) replied that perhaps this would be quite different now that the deposits had been abolished. Alderman Miles further said if the Board could get the consent of half the people occupying houses where the Board desired the gas-mains to be laid, the work of laying them would be proceeded with at once; and he (Colonel Ainsworth) therefore moved that a canvass be made of the householders, to see how many were willing to use gas. The Nuisance Inspector stated that he had made a canvass of the houses in question, and only about one-third were willing to use gas, provided they could have it at the same price as was charged in other towns. Many of the householders appeared to prefer their lamps. Colonel Ainsworth said this really met the question; but no doubt they would be hearing something from the Corporation in the course of a short time.

GEORGETOWN (BRITISH GUIANA) GAS COMPANY, LIMITED.—In the report of the Directors of this Company for the half year ended Dec. 31 last, to be presented to the shareholders at the ordinary general meeting on the 21st inst., it is stated that after paying the dividends to June 30, 1888, the interest on debentures and loans to Dec. 31, 1888, and carrying £500 to the reserve fund, there remains a net available balance of £1692, out of which the Directors recommend the declaration of a dividend for the six months ended Dec. 31, 1888, on the preference share capital at the rate of 8 per cent. per annum, and on the ordinary share capital at the rate of 7 per cent. per annum, both less income-tax (except upon those dividends which are payable to the local shareholders); leaving a sum of £524 to be carried forward. The Engineer (Mr. T. B. Younger) reports that the works and mains are in good order.

ACCIDENT AT THE COLCHESTER GAS-WORKS.—According to yesterday's *Daily Chronicle*, an accident of a remarkable character took place at the Colchester Gas-Works last Saturday morning. It appears that Messrs. R. and J. Dempster, of Manchester, have been for some time engaged in carrying on experiments with a self-feeding retort, similar to that in use at Rochdale. About seven o'clock on Saturday morning, while the men were at work, an explosion occurred, and a large hopper, holding about a ton of coal, fell from a height of 14 feet. Five men were at work beneath, and, but for the fact that a strong spindle and wheel, which were lying there, received the principal part of the weight, they would have been killed. As it was, four of them managed to escape with slight injuries, while the fifth, named Walter Adams, had one of his thighs badly fractured. He was removed to the hospital; and though his condition is serious, hopes of his recovery are entertained.

THE ELECTRIC LIGHTING EXPERIMENT AT BARNET.—At a special general meeting of the Barnet Local Board held on the 25th ult., the Surveyor read a letter, dated the 17th ult., addressed by him to Messrs. H. F. Joel and Co., the electric lighting contractors, returning their plans for permanent works approved, and also the reply of the contractors. Mr. Joel handed in a letter from the Brighton and Hove Electric Light Company to himself, advising him that this Company were not working under a Provisional Order or Licence from the Board of Trade. Mr. James moved—"That, having regard to the unsatisfactory manner in which Messrs. N. F. Joel and Co. have lighted and are lighting the district of the Barnet Local Board, this Authority do not consider it necessary or advisable to assent to or assist the undertakers in obtaining any powers from the Board of Trade under which they would acquire full control of the lighting of the district of this Authority." The motion was freely discussed; and ultimately carried *nem. con.*

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For STOCK MARKET INTELLIGENCE, see *ante*, p. 849.)

Issue.	Share	When ex-Dividend.	Dividend on Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	11 Apr.	10½	Alliance & Dublin 10 p. c.	10	18½—19½	..	5 7 8
100,000	10	„	7½	Do. 7 p. c.	10	13—14	..	5 7 2
800,000	100	2 Jan.	5	Australian (Sydney) 5% Deb.	100	110—112	..	4 9 8
100,000	20	29 Nov.	10	Bahia, Limited	20	24—26	..	7 13 10
200,000	5	14 Nov.	7½	Bombay, Limited	5	7—7½	+½	5 0 0
40,000	5	„	7½	Do. New	4	5½—5¾	..	5 4 2
380,000	Stck.	14 Feb.	11½	Brentford Consolidated	100	229—234	..	5 0 5
125,000	„	„	8½	Do. New	100	167—172	..	5 1 9
220,000	20	14 Mar.	10½	Brighton & Hove, Original	20	42—44	..	4 15 5
330,000	20	28 Mar.	11½	British	20	45—47	..	4 15 9
50,000	10	14 Mar.	11	Bromley, Ordinary 10 p. c.	10	20—22	..	5 0 0
89,000	10	„	8	Do. 7 p. c.	10	13½—14½	..	5 10 4
328,750	10	14 Nov.	8	Buenos Ayres (New) Limited	10	15—16	+½	5 0 0
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	107—110	..	5 9 1
150,000	20	28 Feb.	8	Cagliari, Limited	20	25—27	..	5 18 6
550,000	Stck.	11 Apr.	13½	Commercial, Old Stock	100	270—275	..	5 0 0
130,000	„	„	10½	Do. New do.	100	214—219	..	4 18 2
130,000	„	28 Dec.	4½	Do. 4½ p. c. Deb. do.	100	123—128	..	3 10 8
557,320	20	13 Dec.	13	Continental Union, Limited	20	47—49	..	5 6 2
242,680	20	„	13	Do. New '69 & '72	14	33½—35½	..	5 8 5
200,000	20	„	10	Do. 7 p. c. Pref.	20	38—40	..	5 0 0
75,000	Stck.	28 Mar.	10	Crystal Palace District	100	204—208	..	4 16 2
234,060	10	30 Jan.	13	European, Limited	10	25½—26½	..	4 18 1
120,000	10	„	13	Do. New.	7½	17¾—18¾	..	5 5 3
864,060	10	„	13	Do. do.	5	12¼—13¼	..	4 16 3
5,468,500	Stck.	14 Feb.	13	Gaslight & Coke, A, Ordinary	100	255—259	−5½	5 0 5
100,000	„	„	4	Do. B, 4 p. c. max.	100	100—105	..	3 16 3
665,000	„	„	10	Do. C, D, & E, 10 p.c. Pf.	100	260—265	..	3 15 6
80,000	„	„	5	Do. F, 5 p. c. Prf.	100	128—132	..	3 18 1
60,000	„	„	7½	Do. G, 7½ p. c. do.	100	182—187	..	4 0 2
1,800,000	„	„	7	Do. H, 7 p. c. max.	100	170—175	..	4 0 0
468,000	„	„	10	Do. J, 10 p. c. Prf.	100	258—263	..	3 16 1
1,031,150	„	13 Dec.	4	Do. 4 p. c. Deb. Stk.	100	119—122	−1	3 5 7
294,850	„	„	4½	Do. 4½ p. c. do.	100	125—130	..	3 9 3
650,000	„	„	6	Do. 6 p. c. do.	100	174—179	..	3 7 0
8,600,000	Stck.	14 Nov.	10	Imperial Continental	100	214—218	−1	4 11 9
75,000	5	13 Dec.	6	Malta & Mediterranean, Ltd	5	5—5½	..	5 9 1
560,000	100	1 Apr.	5	Met. of Melbourne, 5 p.c. Deb.	100	113—115	..	4 6 11
541,920	20	29 Nov.	6	Monte Video, Limited	20	18½—19½	..	3 3 1
150,000	5	29 Nov.	10	Oriental, Limited	5	9½—10	+½	5 0 0
60,000	5	28 Mar.	7	Ottoman, Limited	5	6½—6¾	..	5 3 8
166,870	10	16 Jan.	4	Pará, Limited	10	5½—6	..	5 13 4
				People's Gas of Chicago—				
420,000	100	2 May	6	1st Mtg. Bds.	100	101-105*	+½	5 14 3
500,000	100	1 Dec.	6	2nd Do.	100	95—100	..	6 0 0
100,000	10	26 Apr.	10	San Paulo, Limited	10	16—17*	..	5 17 8
500,000	Stck.	28 Feb.	16½	South Metropolitan, A Stock	100	317—322	..	5 0 11
1,350,000	„	„	12½	Do. B do.	100	243—248	−2	4 17 9
141,500	„	„	13½	Do. C do.	100	260—270	..	4 18 1
600,000	„	28 Dec.	5	Do. 5 p. c. Deb. Stk.	100	137—140	..	3 11 5
60,000	5	28 Feb.	11½	Tottenham & Edm'nton, Orig.	5	11—13	..	4 8 5
						*Ex div		
				WATER COMPANIES.				
717,467	Stck.	28 Dec.	9	Chelsea, Ordinary	100	257—269	..	3 8 3
1,730,560	Stck.	11 Apr.	7½	East London, Ordinary	100	204—208	..	3 12 1
700,000	50	13 Dec.	9	Grand Junction	50	123—126	..	3 11 5
708,000	Stck.	14 Feb.	10½	Kent	100	272—277	..	3 15 9
1,043,800	100	28 Dec.	9	Lambeth, 10 p. c. max.	100	251—254	..	3 10 3
406,200	100	„	7½	Do. 7½ p. c. max.	100	199—204	..	3 13 6
200,000	Stck.	28 Mar.	4	Do. 4 p. c. Deb. Stk.	100	118—120	..	3 6 8
500,000	100	14 Feb.	13½	New River, New Shares	100	348—353	−2	3 8 8
1,000,000	Stck.	30 Jan.	4	Do. 4 p. c. Deb. Stk.	100	125—128	..	3 2 6
902,300	Stck.	13 Dec.	6	S'thwk & V'xhall, 10 p.c. max.	100	175—180	+1	3 6 8
126,500	100	„	6	Do. 7½ p. c. do.	100	161—166	..	3 12 3
1,155,066	Stck.	13 Dec.	10	West Middlesex	100	264—269	..	3 14 4

GWYNNE & CO., ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C.

GWYNNE & BEALE'S PATENT GAS EXHAUSTERS & ENGINES.

Telegrams: "GWYNNEGRAM, LONDON." Telephone No. 2698.

Exhausters of nearly all sizes in Stock.

Prize Medals at all the Great International Exhibitions.

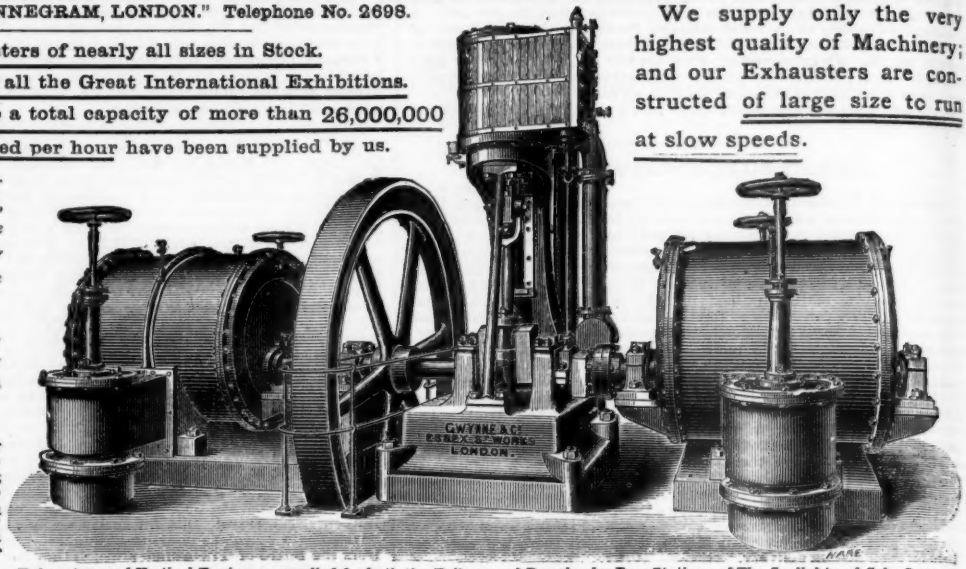
Exhausters equal to a total capacity of more than 26,000,000 cubic feet passed per hour have been supplied by us.

Our new Patent Non-Fluctuating Exhausters, to work without the slightest oscillation or variation in pressure, are strongly recommended.

MAKERS OF EVERY DESCRIPTION OF HYDRAULIC AND GAS MACHINERY.

Gwynne & Co.'s New Catalogue and List of Testimonials can now be obtained on application.

We supply only the very highest quality of Machinery; and our Exhausters are constructed of large size to run at slow speeds.



Exhausters and Vertical Engine as supplied for both the Fulham and Bromley-by-Bow Stations of The Gaslight and Coke Company

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.
JOHN WM. O'NEILL, Managing Director.

ANDREW STEPHENSON, Agent for the GAS PURIFICATION AND CHEMICAL COMPANY, Limited, Palmerston Buildings, Old Broad Street, LONDON, E.C.

CANNEL COAL, &c.

JOHN ROMANS & SON, EDINBURGH. Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS AND WATER WORKS.
Prices, &c., will be forwarded on application to No. 30, ST. ANDREW SQUARE, EDINBURGH, } SCOTLAND.
No. 54, BERNARD STREET, LEITH, }

SHIPPING AND INSURANCE.

ROBERT BRUCE FITZMAURICE, 9, Crosby Square, London, E.C., Shipping Agent to several Foreign Gas Companies, is prepared to attend to the Forwarding and Insurance of Goods for Foreign and Colonial Gas Companies, &c., and Gas Plant Manufacturers.
For Rates of Freight, apply as above.

INCANDESCENT Gas-Lamps, Standards, Brackets, Gaseliers.—The NEW INCANDESCENT GAS-LIGHT (unbreakable Metal Mantles) can now be supplied. Burners, complete for ordinary fittings, from 10s. 6d. Standards for table, complete with Mantle, &c., from 20s.
31, HIGH HOLBORN, W.C.

TO GAS COMPANIES, ETC.

ADVERTISER seeks a Situation as WORKING GAS MANAGER and FITTER in Gas-Works. Is thoroughly practical and experienced in Gas Making and everything connected with Gas-Fitting. Highest testimonials.
Address A. W., care of Mr. F. Baker, Summers, Billingshurst, SUSSEX.

CHEMIST, or Appointment under Management, required by Gentleman, F.C.S., with practical experience, as ASSISTANT MANAGER. Intimate knowledge of Accounts; thorough Gas Chemist.
Address No. 1702, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ASSISTANT SECRETARY OR CHIEF CLERK.

REQUIRED, by a Gentleman at present holding an appointment in a Gas Company's Offices, an APPOINTMENT as above. Eighteen years' experience. Excellent testimonials.
Address No. 1707, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Re-engagement as WORKING MANAGER, where the make is from 8 to 12 millions per Annum. Understands the Manufacture and Distribution of Gas by all the latest Improvements. In present situation over 20 years. Good character.
Address No. 1700, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TIMMIS & CO., of STOURBRIDGE Make only the best quality of FIRE-CLAY RETORTS, BRICKS, TILES, & LUMPS. Also SPECIAL SILICA BRICKS, to stand great heats. All descriptions kept in Stock.
For Prices apply to JAMES LAWRIE AND CO, 1, Whittington Avenue, Leadenhall Street, E.C., Sole Agents for London and District.
Telegraphic Address: "EIRWAL, LONDON."

ALEX. WRIGHT & Co., 55, 55a, and 56, MILLBANK STREET, LONDON, S.W.
[Telegraphic Address: "PRECISION LONDON."]
Makers of Wet and Dry Gas-Meters, Station Meters and Governors, Photometers, and Gas-Testing Apparatus, Test Gasholders and Meters, Registering and other Gauges, &c., &c.
*** See Advertisement on Page III. of the Wrapper of this week's issue.

W. C. HOLMES & Co., Huddersfield, AND 80, CANNON STREET, LONDON,
Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.
*** See Advertisement p. 835 of last week's issue.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award. Melbourne Exhibition, 1889, for Wet and Dry Gas-Meters, Station Meters, and Governors, Pressure-Gauges, Street Lamps, and Pillars, &c.
Telegraphic Address: "Braddock, Oldham."

FORCED DRAUGHT.

MELDRUM BROS., Engineers, of 26, Half Street, Cathedral Yard, Manchester, are prepared to Supply and Fix to any ordinary Boiler Furnace complete APPARATUS for burning Breeze, Coal Dust, or other small or poor Fuel. Results guaranteed. Terms on application.

WANTED, Situation as Assistant MANAGER or FOREMAN under Gas Engineer in large Works. The Advertiser has had considerable experience in the Manufacture and Distribution of Gas. Over Five years in present situation.
Address No. 1706, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

DRAUGHTSMAN wanted, for a Gas Engineering Works. Must be expeditious, used to modern construction, and able to prepare working drawings.
Apply, by letter, stating experience, age, and salary required, to No. 1704, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, on a Carbonizing and Chemical Works, a good GENERAL FITTER, well up in all branches. Married. References.
Apply (by letter only) to No. 1705, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by the Nuneaton Gas Company, a good FITTER, competent to Lay Mains and Services, Fix and Repair Meters, Erect Retort-House Fittings, and do rough Smithing. One who has a knowledge of Gas-Engine and Exhauster, and is also capable of setting Retorts, preferred. To a steady Man, willing to fill up his time on the Works, the situation would be a permanent one.
Apply, with references, stating age and wages required, to
JOHN H. BLAND, Secretary.
Nuneaton, April 27, 1889.

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE, BAKER, & CO., direct Importers from Ireland. Sample and Price on application. Spent Oxide and Sulphate of Ammonia purchased.
120 and 121, NEWGATE STREET, LONDON, E.C.

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, LEEDS, specially produce this ACID for making SULPHATE OF AMMONIA of high quality and colour.
Highest References and all particulars supplied on application.

SULPHATE of Ammonia Lead Work and Fittings. Lead Burner. Tanks and Saturators made and repaired on the shortest notice.
Address P. J. DAVIES, 78, Earl's Court Road, Kensington, LONDON.

SULPHURIC ACID.

HUGH WALLACE & CO., Chemical Manufacturers (the old-established firm), supply the above, which is specially adapted for making White Sulphate of Ammonia. The latter purchased in any quantities at highest market prices, or contracts for the year.
For price and terms apply Botolph House, Eastcheap, LONDON, E.C.

WANTED, by a Coal Factor, Travellers for Southern and Eastern Counties. Must have connection with Gas Companies. State if know any other ground in addition.
Apply, by letter only, to No. 1694, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WORKSOP GAS COMPANY.

WANTED, a Young Man (aged 30 to 35) to assist the Manager. One who will take an interest in the Works, and be obliging to consumers, would find it to his advantage. Must have a good knowledge of Carbonizing; do all Fittings on the Works (including machinery, but not necessarily to be a Gas-fitter); Main and Service Laying; Reading Consumers' Meters, and making out Accounts and taking money in case of change of Tenants, and attend to inquiries of such.
Applications, in own handwriting, stating age, qualifications, present employment, salary required, married or not, with two references (not testimonials), one from present employer, to be sent not later than the 24th day of May, addressed to Mr. BATES, WORKSOP.

WANTED, a few Tank-Waggons—new or good second-hand—to hold from 2000 to 2600 gallons each.
Address, stating price, &c., No. 1701, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED—Any Gas Company having for Sale one LIVESEY WASHER, and one KIRKHAM'S SCRUBBER for 500,000 feet per day, will please communicate with Mr. LONGWORTH, Gas Offices, GUILDFORD.

FOR SALE—One of Anderson's Patent ENGINES and EXHAUSTERS combined; to pass 5000 cubic feet of Gas per hour. In thorough order; can be seen at work at the Gas-Works, Chichester, Sussex. Coming down to be replaced by one of greater capacity.
For further particulars apply to R. S. CHURCH Secretary, Gas-Works, CHICHESTER.

FOR SALE, to close a Partnership Account—About 20 new BOWER LAMPS, assorted, of 10 and 15 feet. Liberal discount to clear. Apply Cox, 146, Miller Street, Aston Road, Birmingham.

FOR SALE—Two good stout Wrought- Iron OIL-TANKS, 7000 and 10,000 gallons each, and three Cast-Iron 4-inch SOCKET ROSIN STILL WORMS, with Wrought-Iron Standards and Clips complete. To be immediately cleared for alterations of premises.
Apply to F. Morris, Tar and Rosin Distiller, Plough Bridge, Rotherhithe, London, S.E.

FOR SALE—Four Purifiers, 16 ft. by 12 ft. by 3 ft. 9 in. deep inside, with 12-inch Centre-Valve (Walker's) and Connections. Practically equal to new. Would erect complete.
Also Four PURIFIERS 12 ft. by 6 ft. 9 in. by 3 ft. deep inside, with 10-inch Centre-Valve and Connections. Do.
Also One Cast-Iron SCRUBBER 40 ft. high by 10 ft. diameter.
Also One Cast Iron SCRUBBER 24 ft. high by 10 ft. diameter.
Inquiries invited for various second-hand Gas Plant—Gasholders, Tanks, Purifiers, Washers, Exhausters, Station Meters, &c.
Apply to Saml. White (late Ashmore and White), 60, Queen Victoria Street, London, E.C.

THE Directors of Stapp's Water Gas Patents, Limited, are prepared to receive APPLICATIONS from Gas Companies at Home and Abroad for the Adoption and Use of their PATENT PROCESS.
All communications to be in writing, and addressed to John Bennett, Secretary.
Stapp's Water-Gas Patents, Limited,
120, Cannon Street, London, E.C.,
May 1, 1889.

MANSFIELD IMPROVEMENT COMMISSIONERS.
(Gas Department.)

THE Mansfield Improvement Commis- sioners invite TENDERS for the supply of 5500 tons of best screened GAS COAL and NUTS, also 700 tons of CANNEL, for use at their Works, to be supplied for One year, ending May 31, 1890.
Particulars may be obtained from Mr. J. Heydon, the Manager at the Gas-Works, Mansfield.
Tenders to be sent in on or before the 23rd day of May, 1889, marked "Tender for Coal," and addressed to
R. J. Parsons,
Clerk to the Commissioners.
Mansfield, May 1, 1889.

MANSFIELD IMPROVEMENT COMMISSIONERS.
(Gas Department.)

THE Mansfield Improvement Commis- sioners invite TENDERS for their surplus TAR for One year, ending on the 30th of June, 1890. The Tar to be removed by the Contractor when required by the Manager.
Monthly cash payments to be made.
The Commissioners do not bind themselves to accept the highest or any tender.
Tenders to be sent in on or before the 23rd of May, 1889, endorsed "Tender for Tar," and addressed to
R. J. Parsons,
Clerk to the Commissioners.
Mansfield, May 1, 1889.

THE Directors of the North Bierley Gas Company are prepared to receive TENDERS for the Erection of Four 20-feet square PURIFIERS, with Centre-Valves and Connections complete.
Drawings may be seen and particulars obtained on application to Mr. W. Oldfield, at the Company's Office.
Tenders, endorsed "Purifiers," addressed to the Chairman, to be delivered at the Company's Office, Oakenshaw, near Bradford, on or before the 15th inst.
The Directors do not bind themselves to accept the lowest or any tender.
W. Oldfield, Manager.
North Bierley Gas-Works, Oakenshaw,
near Bradford, May 4, 1889.

TENDERS FOR COALS.

THE Directors of the Jersey Gaslight Company are prepared to receive TENDERS for the supply of 10,000 tons of best GAS COALS, to be shipped f.o.b. in the Tyne, for One year from the 31st of May, 1889.
Tenders to be sent in on or before the 18th of May, 1889.
By order,
J. Morris, Engineer and Manager.
Gas-Works, Jersey, May 3, 1889.

THE Haslingden Union Gas Company invite TENDERS for the supply of GAS COAL for One, Two, or Three years. Quantity required, about 5000 tons annually.
Tenders not later than Saturday, the 25th of May inst.
Woodcock and Sons,
Secretaries.
West View, Haslingden,
near Manchester, May 3, 1889.

TO TANK CONTRACTORS.

THE Paisley Gas Corporation invite TENDERS for the Construction of a BRICK GASHOLDER TANK, 162 feet diameter and 35 ft. 6 in. deep.
Drawings and specifications may be seen, and all necessary particulars obtained, on application to the undersigned.
Tenders, sealed and endorsed "Tender for Gasholder Tank," to be lodged with Messrs. Young and Martin, Town Clerks, Paisley, on or before the 16th day of May prox.
The Committee will not be bound to accept the lowest or any tender.
Geo. R. Hislop, Engineer.
Paisley Gas-Works, April 23, 1889.

THE BRISTOL UNITED GASLIGHT COMPANY.

TO COLLIERY PROPRIETORS AND OTHERS.

THE Bristol United Gaslight Company are prepared to receive TENDERS for the Supply of their requirements (say, 150,000 tons) of GAS COALS during a period of One year, commencing the 1st of July next.
Particulars and forms of tender may be obtained on application to the undersigned, to whom also tenders, sealed, and endorsed "Tender for Coal," must be delivered not later than Ten a.m., on Monday, the 3rd day of June next.
Jas. V. Green, Secretary.
Gaslight Offices, Canon's Marsh,
Bristol, April 26, 1889.

TAUNTON GASLIGHT AND COKE COMPANY.

TENDERS FOR COAL.

THE Directors are prepared to receive TENDERS for the supply of GAS COAL for delivery over One year, commencing the 1st of July next.
Particulars to be obtained of the undersigned, to whom tenders, sealed and endorsed, may be delivered not later than the 1st of June next.
Alfred Edwards,
Secretary and Manager.
May 4, 1889.

LEEK IMPROVEMENT ACT, 1855.

THE Leek Improvement Commissioners invite TENDERS for a supply of best screened GAS COAL and NUTS for One, Two, or Three years from the 1st of July next, to be delivered at the Leek Station on the North Staffordshire Railway, at such times and in such quantities as may be required. Annual consumption about 3500 to 4000 tons.
Sealed tenders, addressed to the Chairman of the Gas Committee, Leek, to be delivered by Four o'clock in the afternoon of Monday, the 13th of May, 1889.
The lowest or any tender will not necessarily be accepted.
Further particulars may be obtained from the undersigned.
By order of the Commissioners,
C. Henshaw, Clerk.
Town Hall, Leek, April 29, 1889.

THE GAS, WATER, AND GENERAL INVESTMENT TRUST, LIMITED.

Issue of £250,000 Four per Cent. Perpetual Registered Debenture Stock.

NOTICE is hereby given that the LIST OF APPLICATIONS for above will CLOSE this day (Tuesday), May 7, for Town and Country.
By order,
J. A. Kelman, Secretary.
Winchester House, London, E.C.

BOROUGH OF BIRKENHEAD.

TO TAR DISTILLERS AND MANUFACTURING CHEMISTS.

THE Corporation of Birkenhead invite OFFERS for the purchase and removal of the AMMONIACAL LIQUOR and surplus TAR produced at their Gas-Works, for a period of One, Three, or Five years, commencing from the 1st of July, 1889.
A pipe is laid between the Gas-Works and the River Mersey, for the conveyance of Liquor into the Contractors' boats; and the Corporation will, if necessary provide appliances on their own siding, to pump the Products direct into the Contractor's railway tank-wagons.
Forms of tender and further particulars may be obtained from Mr. T. O. Paterson, C.E., Gas Engineer, at the Gas-Works, Thomas Street.
Tenders, sealed and endorsed "Tender for Ammoniacal Liquor or Tar," must be sent in to me not later than Five p.m., on Friday, the 31st of May, 1889.
The Corporation do not bind themselves to accept the highest or any offer.
By order,
Alfred Gill, Town Clerk.
Town Hall, Birkenhead, April 29, 1889.

TO COAL PROPRIETORS.

THE Corporation of Birkenhead are prepared to receive TENDERS for the supply of the best quality of screened COAL, COAL NUTS, CANNEL, and CANNEL NUTS, for Gas Making purposes, for a period of One, Two, or Three years, commencing from the 26th of June, 1889.
Forms of tender, together with any further information, may be obtained from Mr. T. O. Paterson, C.E., Gas Engineer, Gas-Works, Birkenhead.
Tenders, stating the price per ton delivered on to the Gas-Works Railway Siding, must be sent in to me, sealed and endorsed "Tender for Gas-Works Coal," not later than Five o'clock in the afternoon of Friday, the 7th of June, 1889.
Also for a supply of STEAM COAL and SLACK, to be delivered at the Pumping-Stations of the Spring Hill, Playbrick Hill, and Borough Road Water-Works, for a period of One, Two, or Three years, commencing from the 26th of June, 1889.
Forms of tender and any other information may be obtained from Mr. W. A. Richardson, C.E., Water Engineer, Town Hall, Birkenhead.
Tenders, stating the price per ton delivered at the various Pumping-Stations, must be sent in to me, sealed and endorsed "Tender for Water-Works Coal," not later than Five o'clock in the afternoon of Friday, the 7th of June, 1889.
Deliveries to be made from time to time according to the requirements of the respective Engineers.
The Corporation do not bind themselves to accept the lowest or any tender.
By order,
Alfred Gill, Town Clerk.
Town Hall, Birkenhead, April 29, 1889.

TO ENGINEERS, ETC.

THE Corporation of Birkenhead are prepared to receive TENDERS for the Supply and Erection of STAGE FLOOR, HYDRAULIC MAINS, RETORT-BENCH FITTINGS, &c., at their No. 3 Retort-House, Gas-Works, Thomas Street, Birkenhead.
Plans and Specifications may be seen and Quantities obtained (upon deposit of one guinea), from the Engineer, Mr. T. O. Paterson, at the Works.
Tenders, sealed and endorsed "Retort-House Ironwork," must be sent in to me not later than Five p.m. on Friday, the 17th of May, 1889.
The Corporation do not bind themselves to accept the lowest or any tender.
By order,
Alfred Gill, Town Clerk.
Town Hall, Birkenhead, April 24, 1889.

Complete in Three Volumes. Price £4 4s., handsomely bound in Morocco, cloth sides, gilt edges.

KING'S TREATISE on the SCIENCE & PRACTICE of the MANUFACTURE & DISTRIBUTION of COAL GAS.

Edited by THOMAS NEWBIGGING, C.E., M. Inst. C.E., and (the late) W. T. FEWTRELL, F.C.S.

[To enable those who purchased the first two volumes in parts to have the binding of the 3rd Volume to match, sheets (price 22s.) can be had on application to the Publisher]

LONDON: WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

SIXTH YEAR. Now Ready (Demy 8vo., Price 5s., or 5s. 6d. post free),

THE COMPLETE REPORTS OF THE PROCEEDINGS

OF THE VARIOUS

DISTRICT ASSOCIATIONS OF GAS MANAGERS

FOR 1888.

FORMING A COMPANION VOLUME TO THE TRANSACTIONS OF THE GAS INSTITUTE, WITH WHICH IT IS UNIFORM IN SIZE.

*** THE VOLUMES for 1883 to 1887 ARE STILL ON SALE.

LONDON: WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

TO COLLIERY PROPRIETORS.

THE Directors of the Sligo Gas Company invite TENDERS for the supply and delivery of 1500 tons of good screened GAS COAL and 300 tons of CANNEL (21 cwt. to the ton), to be delivered during the months of July, August, and September, in Sailing Vessels of about 300 tons, delivered free *ex* ship at Sligo.

Payments, net cash within One month from delivery at Sligo.

The Directors do not bind themselves to accept the lowest or any tender.

Tenders, endorsed "Tender for Gas Coal," to be sent to the Chairman on or before May 23, 1889.

C. B. TULLY, Engineer and Manager.

Gas-Works, Sligo, May 1, 1889.

THE Gas Committee of the Leeds Corporation are prepared to receive TENDERS for the supply of about 60,000 tons of CANNEL and about 160,000 tons of best GAS COALS (Screened or Nuts).

Price per ton to be quoted, delivered at their Gas-Works, Meadow Lane (Hunslet Lane Siding), New Wortley (Gelderd Junction Siding), or at the Gas-Works, York Street, in such quantities as may be required.

The contract to commence the 1st of July next, and terminate June 30, 1890.

Forms of tender may be obtained on application to Mr. Lupton, Gas Department, Municipal Offices, Calverley Street.

Tenders may be for any portion of the total quantity required, and will be received not later than Wednesday, the 15th of May next, addressed to the Chairman of the Gas Committee, Municipal Offices, Calverley Street, and endorsed "Tender for Coal."

The lowest or any tender will not necessarily be accepted.

TENDERS FOR GAS COAL.

THE Gas Committee of the Stockton Corporation invite TENDERS for the supply, in whole or in part, of 24,000 tons of clean, well-screened or treble NUTS GAS COAL, similar in quality to sample wagon, to be supplied to the Gas Committee, if so requested.

The Coal to be delivered, free from all dues, in the Gas-Works Siding, in a dry state; free from Dirt, Shale, or other impurities, and in such daily quantities as may from time to time be directed by the Gas Manager.

Payments will be made monthly after each Council Meeting.

The Gas Committee do not bind themselves to accept the lowest or any tender.

Tenders, specifying the quantity and description of Coal offered, to be sealed and endorsed "Tender for Gas Coal," to be lodged with me on or before the 29th day of May, 1889.

WM. FORD, Manager.

Corporation Gas Works,
Stockton-on-Tees, May 6, 1889.

BOROUGH OF CHORLEY.

TO COLLIERY PROPRIETORS, TAR DISTILLERS, AND OTHERS.

THE Chorley Corporation are prepared to receive TENDERS for the supply of all the GAS COAL required at their Gas-Works, for a period of One, Two, or Three years, from the 1st of September next.

Also for the supply of about 500 tons of CANNEL during Twelve months, from the 1st of June next.

Also for the purchase of the SURPLUS TAR produced at their Gas-Works during Twelve months, commencing the 1st of July next, delivered in Contractor's Tanks at the Chorley Railway Station. Approximate quantity, 400 tons.

Forms of tender for Gas Coal, and further information respecting any of the tenders, may be obtained on application to Mr. William Blackledge, Gas Manager, Chorley.

Sealed tenders, endorsed "Gas Coal," "Cannel," or "Tar," as the case may be, to be sent to the undersigned, before Noon on Wednesday, the 22nd of May, 1889.

The Corporation do not bind themselves to accept any tender.

By order,
THOS. A. JACKSON, Town Clerk.

Town Hall, Chorley, April 30, 1889.

COKE AND TAR.

THE Directors of the Nuneaton Gas Company invite TENDERS for the surplus COKE and TAR to be produced at their Works for One year from the 1st day of July next.

Quantity of Coke, about 800 tons; quantity of Tar about 150 tons.

Tenders, sealed and endorsed, must reach me not later than Wednesday, the 8th of May.

JOHN H. BLAND, Secretary.

Nuneaton, April 27, 1889.

TENDERS FOR COAL.

THE Scarborough Gas Company invite TENDERS for the supply of about 8000 tons of best screened SILKSTONE GAS COAL or COBBLES per Annum, for One or Two years, from the 1st day of July next.

Tenders, endorsed "Tender for Coal," must be delivered at the Company's Offices not later than Ten o'clock a.m. on Monday, the 13th day of May next.

The Directors do not bind themselves to accept the lowest or any tender.

By order,
WILLIAM J. MOON,
Secretary and Manager.

Scarborough, April 24, 1889.

CITY OF MANCHESTER.

TENDERS FOR COAL AND CANNEL.

THE Gas Committee are prepared to receive, on or before the 23rd of May next, OFFERS of high-class CANNELS and COALS, suitable for Gas Making, for delivery at their Gaythorn, Rochdale Road, and Bradford Road Works, during a period of One, Two, or Three years, commencing the 1st of November, 1889.

Particulars and printed forms of tender may be obtained on application (in writing only) to Mr. Charles Nickson, Superintendent, Gas Department, Town Hall, Manchester.

By order of the Gas Committee,
JOSEPH HERON, Town Clerk.

Town Hall, Manchester, April 26, 1889.

MANCHESTER CORPORATION GAS-WORKS.

SPENT OXIDE.

THE Gas Committee of the Corporation of Manchester are prepared to receive TENDERS for the PURCHASE and REMOVAL of the SPENT OXIDE to be produced at their Gaythorn, Rochdale Road, and Bradford Road Works, during a period of One, Two, or Three years from the 30th of June next.

The Committee do not bind themselves to accept the highest or any tender.

Sealed tenders, addressed to the Chairman of the Gas Committee, and endorsed "Tender for Spent Oxide," must be delivered at the Offices of the Gas Department, Town Hall, on or before Thursday, the 23rd day of May next.

Forms of tender and further particulars may be obtained on application, in writing, to Mr. Charles Nickson, Superintendent of the Gas Department.

By order of the Gas Committee,
JOSEPH HERON, Town Clerk.

Town Hall, Manchester, April 26, 1889.

MANCHESTER CORPORATION GAS-WORKS.

TAR AND AMMONIACAL LIQUOR.

THE Gas Committee of the Manchester Corporation are prepared to receive TENDERS for the PURCHASE and REMOVAL of the TAR and AMMONIACAL LIQUOR to be produced at their Droylsden Station during a period of One or more years from the 24th of June next.

The Committee do not bind themselves to accept the highest or any tender.

Sealed tenders, addressed to the Chairman of the Gas Committee, and endorsed "Tender for Tar and Liquor, Droylsden," must be delivered at the Offices of the Gas Department, Town Hall, on or before Thursday, the 23rd day of May next.

Forms of tender and further particulars may be obtained on application, in writing, to Mr. Charles Nickson, Superintendent of the Gas Department.

By order of the Gas Committee,
JOSEPH HERON, Town Clerk.

Town Hall, Manchester, April 26, 1889.

CORPORATION OF LEICESTER.

COAL TENDERS.

THE Gas Committee of the above Corporation are prepared to receive TENDERS for the supply of COALS, COBBLES, or NUTS (about 95,000 tons per annum), for One, Two, or Three years ending May 31.

Particulars and form of tender can be obtained on application to the Engineer.

Tenders, addressed to Councillor Lennard, Chairman, and endorsed "Tender for Gas Coal," to be delivered at these Offices not later than Eleven o'clock a.m. on Saturday, May 11 prox.

The Committee do not bind themselves to accept the lowest or any tender.

ALFRED COLSON, C.E.,
Engineer and Manager.

Gas Offices, Millstone Lane, Leicester,
April 11, 1889.

ROCHESTER, CHATHAM, AND STROOD GAS-LIGHT COMPANY.

SUPPLY OF COALS.

THE Directors of the above Company invite TENDERS for the supply of 34,800 tons of GAS COALS, to be delivered in the Year commencing the 1st of July next, and ending the 30th of June, 1890.

Particulars and copy of form of contract may be had on application to

WILLIAM SYMS,
Secretary and Manager.

Gas Office, 58, High Street, Rochester,
April 27, 1889.

TO TAR DISTILLERS, MANUFACTURING CHEMISTS, AND OTHERS.

THE Directors of the Rochester, Chatham, and Strood Gaslight Company are prepared to receive TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR produced at their Works at Rochester and at Gillingham for One, Two, or Three years, commencing the 1st of July next. In 1888 the quantity of Tar was about 290,000 gallons of Liquor, about 910,000 gallons.

Further particulars may be had on application at the Office of the Company, 58, High Street, Rochester.

Tenders may be for Tar or Liquor separately or together, and are to be delivered at the Office, marked "Tender for Tar" or "Liquor," not later than Noon of Thursday, the 23rd of May.

The Directors do not bind themselves to accept the highest or any tender; and security for due fulfilment of the contract must be given if required.

WILLIAM SYMS,
Secretary and Manager.

Gas Office, 58, High Street, Rochester,
April 27, 1889.

Improved Edition, on Superior Paper.

SANDELL'S GAS COMPANIES EXPENDITURE JOURNAL.

Being a Ruled Account Book, with Printed Headings and Analyzing Guide, for Keeping (upon the easiest and most correct method) the Expenditure of a Gas Company in accordance with the provisions of the Gas-Works Clauses Act of 1871, and suitable for all Companies.

Prices:

Half Quire, 10s.; *One Quire*, 16s.
Half Bound, Cloth Sides—Two Quires, 36s.; *Three Quires*, 44s.

TO BE HAD OF THE PROJECTOR,

EDWARD SANDELL, Chartered Accountant, No. 181, Queen Victoria Street, E.C.

OR OF

WALTER KING, "Journal of Gas Lighting," 11, Bolt Court, Fleet Street, E.C.

SIXTY PER CENT. ECONOMY IN GAS LIGHTING.

The Schülke Regenerative Lamp

FOR

DOMESTIC AND EXTERNAL LIGHTING.

The only Regenerative Lamp employing the Common Flat-Flame Burners.

Lamps giving 20-Candle power consume less than four feet of Gas per hour.

A PURE WHITE & PERFECTLY STEADY LIGHT,

NOT AFFECTED BY DRAUGHTS.

Suitable for any existing fittings (Brackets or Suspending).

Can be fixed in a few minutes.

May be seen at the Offices of the

SCHÜLKE GAS-LAMP Co.

LIMITED,

Room 446—11, QUEEN VICTORIA STREET, LONDON, E.C.,

Where Price Lists and full particulars may be obtained.

TO INVENTORS AND PATENTEES.

MR. W. H. BENNETT having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their Invention may be secured for Twelve months; or LETTERS PATENT, which are granted for Fourteen Years.

Patents completed, or proceeded with at any stage, thereby rendering it unnecessary for persons resident in the country to visit London.

Patents procured for Foreign Countries.

Information as to cost, &c., supplied gratuitously upon application to the Advertiser, 22, Great George Street WESTMINSTER.

THOMAS TURTON AND SONS, LIMITED,

SHEAF AND SPRING WORKS

SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY FOR ENGINEERS.

STEEL OF ALL DESCRIPTIONS.

SCREW STOCKS, TAPS AND DIES, SPANNERS RATCHET BRACES, LIFTING-JACKS, ANVILS, VICES, ND ENGINEERS' TOOLS GENERALLY.

LONDON OFFICE:

90, CANNON STREET, E.C.

THE ONLY RELIABLE

DRY CENTRE-VALVE.

WORKING ONE, TWO, THREE, OR FOUR PURIFIERS ON AT THE TIME.

ALSO MADE FOR TWO OR THREE PURIFIERS.

No Springing. No Leakage. No Foul Gas passed in Changing. Special Facility for Blowing the Air out of the Fresh Box before putting in Action, without driving it forward into the Holders.

Write for Prospectus.

ALSO DOUBLE-ACTION DOUBLE-FACED GAS & WATER VALVES.

F. WECK, 86, NEW STREET, BIRMINGHAM.

SILICA OR GANISTER BRICKS

OF VARIOUS SIZES,

GROUND GANISTER, FIRE-BRICKS, &c.

SUPPLIED FROM

PEASE'S WEST WORKS, CROOK, BY

PEASE & PARTNERS, Limited,

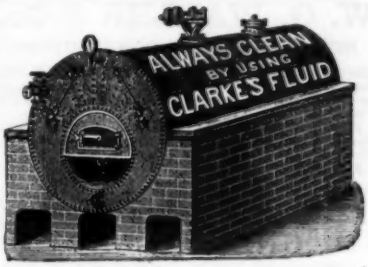
DARLINGTON.

PRICE'S PATENT COKE & COAL BARROW

effecting a great saving of time, labour, and expense.

For particulars, price &c., apply to Mr. E. PRICE, Inventor and Patentee, Gas-Works, Hampton Wick, MIDDLESEX.

Prices are Reduced.



A 10-H.P. BOILER

KEPT PERFECTLY CLEAN FOR

ONE SHILLING PER WEEK

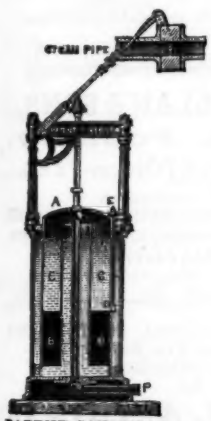
And much smaller Coal Bills. Softens the Hardest Water, and keeps Gauge-Glasses quite clear.

H. CLARKE & Co., Ld., Ipswich.

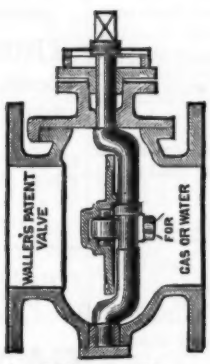
GEORGE WALLER & Co.'s NEW PATENT EXHAUSTER.

MADE WITH FOUR OR THREE BLADES.

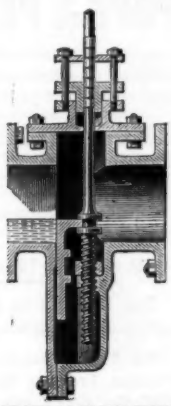
Also BEALE'S EXHAUSTERS.



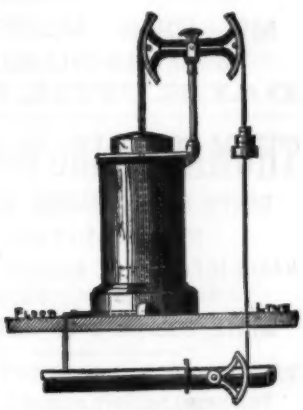
PATENT GOVERNOR.



CRANK VALVE.

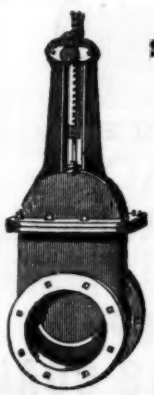


HYDRAULIC MAIN VALVE.

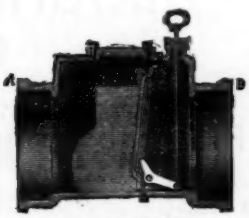


GAS GOVERNOR.

SCRUBBERS, PURIFIERS, CONDENSERS, COKE-BREAKERS.



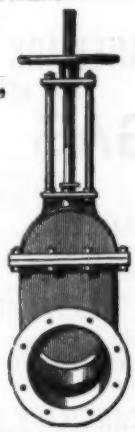
OUTSIDE RACK VALVE.



BYE-PASS VALVE.

INDEX VALVE.

DISC VALVE.



OUTSIDE SCREW VALVE.

SEE PREVIOUS ADVERTISEMENTS. ILLUSTRATED CATALOGUE ON APPLICATION.

Phœnix Engineering Works, Park Street, Southwark, London, S.E.,

NEAR SOUTHWARK BRIDGE (FOUR MINUTES FROM HOLLAND STREET), AND AT

STROUD, GLOUCESTERSHIRE.

Price 5s. per 100, post free.

The Composition and Use of Gas Lime in Agriculture.

By (the late) Dr. A. VOELCKER,

Professor of Chemistry to the Royal Agricultural Society of England.

London: WALTER KING, 11, Bolt Court, FLEET ST., E.C.

IMPROVED RETORT SETTING.

W. G. WALLER & Co.,

RETORT SETTERS & CONTRACTORS,

Having had much experience in the Setting of Retorts, beg to call the attention of Gas Engineers and Managers to their Improved System of Setting Retorts and Tar-Furnaces.

Contractors for Building Shafts, Tanks, Retort Benches, and all other Buildings connected with Gas-Works.

Estimates on application.

The Poplars, Waddon, Croydon, Surrey.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.

MIRFIELD, NORMANTON.

MARQUIS OF LOTHIAN'S

NEWBATTLE CANNEL.

QUOTATIONS ON APPLICATION TO

MR. JOHN MORISON,

NEWBATTLE COLLIERIES,

DALKEITH, N.B.

THOMAS ILLINGWORTH,

NORTH DEAN CHEMICAL WORKS,

Near HALIFAX,

MANUFACTURER OF SULPHURIC ACID

OF EXTRA QUALITY FOR MAKING

WHITE SULPHATE OF AMMONIA.

TAR, LIQUOR, AND SPENT OXIDE Purchased for Cash against Delivery.

THE

LANEMARK COAL Co., LTD.,

Now offer their superior

GAS COALS

LANEMARK CANNEL.

Yield of Gas per ton . . 10,880 cub. ft.
Illuminating Power . . 29·21 candles.
Coke per ton . . . . 1266·96 lbs.

LANEMARK GAS COAL.

Yield of Gas per ton . . 11,879 cub. ft.
Illuminating Power . . 17·88 candles.
Coke per ton . . . . 1285·53 lbs.

LANEMARK GAS BRIQUETTES.

Yield of Gas per ton . . 10,734 cub. ft.
Illuminating Power . . 22·70 candles.
Coke per ton . . . . . 1820 lbs.

For Prices and Analyses, apply to

LANEMARK COAL Co., Ltd.,

NEW CUMNOCK, N.B.

TROTTER, HAINES, & CORBETT,

BRETTELLS' ESTATE

FIRE-CLAY & BRICK WORKS,

STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICK,

Proprietors of

BEST GLASSHOUSE POT & CRUCIBLE CLAYS.

SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

ROBERT MARSHALL,

CANNEL COAL MERCHANT,

97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on application.

CAST-IRON PIPES

FOR GAS AND WATER.

VALVES

FOR GAS, WATER, AND STEAM.

TELEGRAMS: "PIPES GLASGOW."

WM. MACLEOD & CO.,

56, ROBERTSON STREET, GLASGOW.

GAS COAL.

POPE & PEARSON, LTD.,

have now the authority of several of the most eminent Gas Engineers of London in stating that their Coal yields in practical working over 10,000 cubic feet of gas, with an illuminating power of 16 candles; or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.

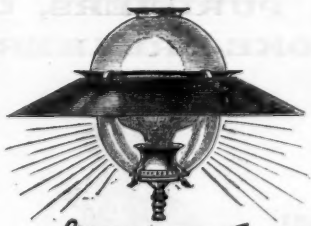
One ton yields 12¼ cwt. of good coke.

This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

For further particulars apply to POPE AND PEARSON, LIMITED, West Riding and Silkstone Collieries, near LEEDS.

THE

"SILVER" LIGHT.



CHANDLER'S PATENT.

SUITABLE FOR EVERY FORM OF LIGHTING.

A beautiful white light from ordinary Gas. Silent, steady, and economical.

PACKED IN BOX 9s., SUBJECT.

S. CHANDLER & SONS,

Central Works, Kennington Oval, S.E.

JAMES OAKES & CO.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

WENLOCK IRON WHARF, 21 & 22, WHARF ROAD, CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter; and make and erect to order RETORTS, PURIFIERS, and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts, and covers and rendering leakage impossible.

ARMSTRONG'S

PATENT

CANDLE SAFETY LAMPS.

8, MANCHESTER STREET, GRAY'S INN ROAD, W.C.

GAS AND WATER PIPES.

1¼ to 12 IN. BORE.

THOMAS ALLAN & SONS,

Bon Lea Foundry,

SOUTH STOCKTON-ON-TEES.

ALSO MANUFACTURERS OF

SANITARY & RAIN-WATER PIPES, HOT WATER PIPES, STABLE FITTINGS, RANGES, STOVES, And GENERAL CASTINGS.

GLASGOW OFFICE: 7, WEST GEORGE STREET.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE

BOGHEAD CANNEL.

Yield of Gas per ton . . . . . 13,155 cub. ft.
Illuminating Power . . . . . 38·22 candles.
Coke per ton . . . . . 1,301·83 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·3 candles.
Coke . . . . . 70 per cent.

For Prices and complete Analysis, apply to

YOUNG, DANCE, & CO.,

COAL OWNERS, NEWCASTLE-ON-TYNE,

Or E. FOSTER & CO., 31, John St., Adelphi, LONDON, W.C.

JAMES NEWTON & SONS,
(Established 1820)
FIRE-BRICK AND TILE MERCHANTS,
Wholesale and for Exportation,
FALCON DOCK, 78 AND 79, BANKSIDE,
SOUTHWARK, LONDON, S.E.
DEPÔT for STOURBRIDGE AND NEWCASTLE FIRE-BRICKS, LUMPS, TILES and FIRE-CLAY and every Article suitable for
GAS AND WATER WORKS.

For FIRE-BRICKS, the most durable for GAS-FURNACES,
ADDRESS
JAMES WHITE & Co.,
ALBERT WORKS, WIDNES.

TAR AND LIQUOR PURCHASED
JOHN CLARKSON MAJOR,
(Established 1851,)
Tar Distiller and Manufacturing Chemist,
WOLVERHAMPTON.
BRANCH WORKS:—
SCULCOATS, HULL.

FACE YOUR RETORT MOUTHPIECES.
JOHN RUSCOE calls attention to his Retort Mouthpiece and Lid Facing Machines, which are in extensive use; also to his Lathes, Drilling, Slotting, Grooving, and Planing Machines, Smiths' Hearths, Smithy Fans, Roots' Blowers; also special Screwing Machines for Gas Tubes and Bolts, Taps, Wrenches, Pipe Cutters, special Taper and Twisted Rymers, Drills, &c.

PATENT TWISTED TAPS, DIES, & CUTTERS.
Thousands in constant work, give universal satisfaction.
Work Easier, Less Friction, Last Longer, and do Better Work than straight Grooves.
Main Drilling Stand, with Cup Drills, 1¼ to 6 inch; Taps, Rymers, and Drills.
Ratchet Screwing Stocks, and Adjustable Once-up Stocks, Dies, Guides &c.
Inquiries and Trial Orders Solicited. Everything Guaranteed. Apply to
JOHN RUSCOE, Albion Works, Hyde, near Manchester.

LAMBERT BROS. ALPHA TUBE AND FITTING WORKS, WALSALL
MANUFACTURERS OF WROUGHT-IRON TUBES AND FITTINGS, BRASS GAS-FITTINGS, GAS-VALVES, STEAM AND WATER VALVES, &c.,
And of WARNER'S PATENT MARKET GAS STAND-PIPE.
LONDON: T. LAMBERT & SONS, SHORT STREET, LAMBETH, S.E.

Glass-House Furnace Bricks.
BLAST-FURNACE BRICKS.
Best Staffordshire Blue Bricks.
Please address "MOBBERLEY & PERRY, STOURBRIDGE," as there are other Firms similar in name.

FIRE BRICKS: GAS RETORTS
LARGE STOCKS ON HAND
SILICA BRICKS & BLOCKS FOR INTENSE HEATS

CASTINGS & EVERY REQUISITE FOR GAS WORKS
LARGE STOCKS ON HAND
MOBBERLEY & PERRY
STOURBRIDGE
SPECIAL BRICKS FOR SECONDARY AIR SUPPLY & REGENERATOR FURNACES

EXPERIENCED RETORT SETTERS SENT TO ALL PARTS OF THE KINGDOM

BLOCKS, LUMPS, AND TILES,
Boiler Seatings, and Flue Covers.
Best Glass-House Pot & Crucible Clay.
Please address "MOBBERLEY & PERRY, STOURBRIDGE," as there are other Firms similar in name.

CAST-IRON PIPES, ETC.
THOMAS SPITTLE, LTD.
[ESTABLISHED OVER 50 YEARS.]
CAMBRIAN FOUNDRY, NEWPORT, MON.,
MAKERS OF
CAST-IRON PIPES FOR GAS, WATER, AND STEAM.
ALSO
Retorts, Mouthpieces, Lamp-Posts, Hydraulic Mains, H-Pipes, Dip-Pipes, Buckstaves, Ash-pans, Sight-Holes, Syphons, Ascension-Pipes, Fire Doors and Frames, Fire-Bars, Hydrants, Valves, Purifiers, Tanks, Columns, &c., &c.
ALSO ALL WROUGHT-IRON WORK.
THE LARGEST MAKERS IN WALES.

SPECIALITIES.
THE "NUGENT" RECUPERATIVE RETORT SETTINGS and FURNACES.
"ROBUS" IMPROVED RETORT SETTINGS, with COKE, TAR, and BREEZE FURNACES.
THE ABOVE SETTINGS & FURNACES ARE PROVING EMINENTLY SATISFACTORY.
Every Particular, with Estimates, forwarded upon Application to
MESSRS. J. & H. ROBUS,
CONTRACTORS FOR THE ERECTION OF GAS & WATER WORKS,
37, WALBROOK, LONDON, E.C.

BELL'S ASBESTOLINE.

REGISTERED.

All kegs are labelled as above.

ADVANTAGES OF ASBESTOLINE.

ASBESTOLINE is the most efficient Lubricant for all bearings.
ASBESTOLINE is the cheapest Lubricant.
ASBESTOLINE saves from 50 to 90 per cent. of the Cost of Oil.
ASBESTOLINE is the Cheapest Lubricant.
ASBESTOLINE is favoured by Insurance Companies.
ASBESTOLINE is the most Inodorous Lubricant.
ASBESTOLINE is the safest Lubricant from Ignition.
ASBESTOLINE has beaten all other Lubricants in trials.
ASBESTOLINE is applicable in and out doors in every Climate.
ASBESTOLINE requires no special application.

BELL'S ASBESTOS.

CONSISTENCY OF ASBESTOLINE.

ASBESTOLINE, to meet all circumstances, is made in four degrees of consistency—A, B, C, and CC.

ASBESTOLINE, A, is specially adapted to ordinary Land Engines and Machinery, in and out door, in this country.

ASBESTOLINE, B, a little more solid, is for use on Steamships in temperate climates, also on land when it is desirable to have Lubricant stiffer than A.

ASBESTOLINE, C, is for use in tropical climates, both ashore and afloat. It is also invaluable in works in this country when the temperature is high.

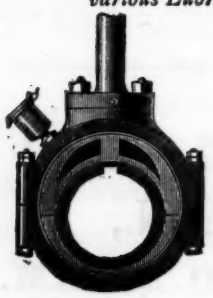
ASBESTOLINE, CC, is designed for use on Calenders, Paper-Machines, &c., where the bearings are heated by steam passing through, and sometimes is advantageously used instead of C.

The reputation of Asbestoline as a Lubricant of the highest efficiency in every kind of Machinery is established; and it has never been equalled by any other Lubricant in the numerous cases of special difficulty in which the best oils are ineffectual. It is used with marked success in Steel and Iron Works, Collieries, Cotton and Wool Mills, and other Textile Manufactories. In Corn-Mills it has proved invaluable on the roller and other modern machines. In Saw-Mills, on machines going up to 5000 revolutions per minute, its work has never been approached by any other Lubricant. On Electric Lighting Machinery, and in Steamships of all sizes throughout the world, the success of Asbestoline is unequalled. Many engines and machines of all descriptions give trouble, and show bad results both in working and wear, when the system of lubrication has not received due consideration. Engineering firms of the highest standing have given to it their powerful testimony and support.

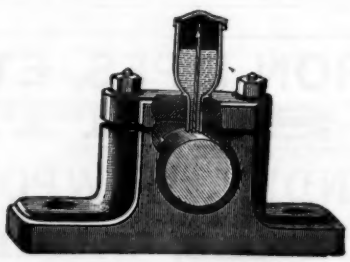
Supplied in Kegs, 28, 56, or 112 lb. Price, 2/3 per lb. Kegs Free. Special Terms for Large Quantities.

IMPORTANT TO EXPORT MERCHANTS.—*One pound of "Asbestoline" equals 2 gallons of Oil weighing 18lbs.; consequently the saving in freight is very considerable. Liberal Terms are conceded to Export Merchants.*

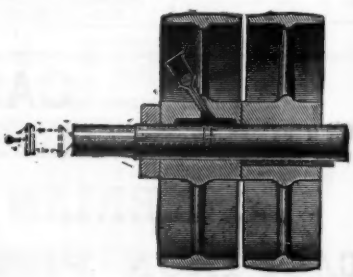
Below will be found illustrations of the mode of fixing Lubricators for Asbestoline to bearings. Full particulars of the various Lubricators supplied for Asbestoline, and the manner of fitting, in catalogue free on application.



Lubricator fitted to Eccentric of Vertical Engine



Showing Section of Lubricator fitted to ordinary Bearings.



Lubricator in different position for Loose Pulleys.

THE ATTENTION OF

ENGINEERS, AND ALL USERS OF STEAM POWER AND MACHINERY,

IS SPECIALLY INVITED TO THE FOLLOWING REPORT.

Owing to the number of Greases now offered, samples of BELL'S ASBESTOLINE were submitted to Otto Hehner, Esq., for analysis, and the subjoined Report fully proves BELL'S ASBESTOLINE to be the safest as well as the best Lubricant for all purposes:—

The Laboratory, 11, *Billiter Square, E.C., London, May* 3, 1888.

I have subjected a sample of Bell's Asbestoline taken from the stores of Messrs. J. Bell and Son, in Southwark Street, to a number of tests, in order to ascertain whether its use in Mills or Factories might contribute to the danger from Fire.

I found that Asbestoline **ignites only with the greatest difficulty** when brought into contact with flame; that wood and other combustible material soaked in Asbestoline burns, if anything, with greater difficulty than by itself; that its **flashing point** is so high that it lies **beyond the range of Mercurial Thermometers**; and that consequently no friction obtainable in the ordinary run of machinery is capable of developing inflammable vapours from it.

Bell's Asbestoline is **as absolutely safe a Lubricant as can be desired or obtainable.** In the case of fire breaking out from any cause, it does not assist the conflagration; and it is **quite incapable of leading to spontaneous combustion,** either by itself or in contact with inflammable material.

From the physical nature of Asbestoline its use is of necessity perfectly clean and free from waste.

(Signed) OTTO HEHNER, Public Analyst.

Illustrated Priced Catalogue, with numerous Testimonials by Leading Firms, free on application.

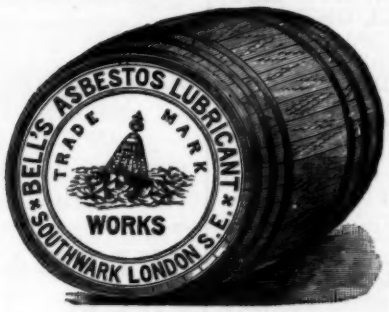
BELL'S ASBESTOS COMPANY, LIMITED,

DEPOTS—MANCHESTER: Victoria Buildings, Deansgate. **LIVERPOOL:** 2, Strand Street, James Street.

BELL'S ASBESTOS LUBRICANT.

(REGISTERED.)

All Drums marked as above.



Every Cask is sent out as above.

All Corks are sealed as above.

Any Customer receiving Oil sold as Bell's Asbestos Lubricant, and Cask, Drum or Corks not marked as above, is earnestly requested to forward us sample and particulars of where obtained.

The following Oils, refined and prepared by our Asbestos process, are specially recommended to Users of Machinery of every kind in all parts of the world. We guarantee the quality of each to be unequalled at the price for the purpose named, and a Sample Drum, containing 5 gallons of each or any sort, will be sent on approval to any respectable firm in any part of the world:—

BELL'S SPECIAL GAS-ENGINE OIL.—This oil is guaranteed to stand flame temperature, and is suitable for light Machinery and Shafting where gas power is used.
Price 2s. 9d. per gallon.

1a.—**BELL'S SPECIALLY PURIFIED DARK CYLINDER AND VALVE OIL.**—This oil is guaranteed not to gum, corrode, or in any way injure metal surfaces. It will not carbonize, nor leave any deposit whatever in cylinders or condensers, nor will it injure india-rubber valves. It is absolutely pure hydrocarbon, and will work admirably in all good Sight-feed Lubricators.
Price 3s. 9d. per gallon.

2a.—Bell's Specially Refined and Purified Pale Cylinder and Valve Oil contains the same properties as 1a, and is one of the very best Oils of the Valvoline class in the market.
Price 4s. 6d. per gallon.

BELL'S PALE COMPOUND MACHINERY AND ENGINE OIL FOR EXTERNAL LUBRICATION ONLY.

"3c."—For small and medium-sized Engines, Shafting, and quick-running Machinery, displacing Lard Oil. Price 2s. 6d. per gallon.

"3c. Special."—Heavier bodied than "3c.," and suitable for Locos. and Stationary Engines up to 300-H.P., displacing Olive Oil.
Price 2s. 9d. per gallon.

"3c. Marine."—Much heavier than "3c.;" suitable for Marine Engines and heaviest Stationary Engines, Shafting, &c., displacing Castor Oil. Price 3s. per gallon.

BELL'S AGRICULTURAL MACHINE OIL, for Traction Engines, Road Rollers, and all Machines working out of doors. This Oil will not set on bright parts, is not affected by extreme cold or the rays of the sun. Price 2s. 9d. per gallon.

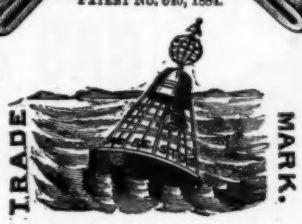
For other Qualities and Prices, with Testimonials, see Catalogue, free on application.

BELL'S ASBESTOS

EXPANSION SHEETING.

The above, which can only be obtained from this house, is recognized as the Most Efficient and Economical Jointing Material in use. It is composed of a specially prepared India-rubber Compound, protected by a covering of Vulcanized Asbestos Sheeting, as shown above, and as it is the only Jointing Material which adequately combines PERMANENT ELASTICITY WITH HEAT RESISTANCE, the advantage it possesses will at once be seen.

SECTION OF SHEETING.
PATENT No. 640, 1884.



BELL'S ASBESTOS.

EXPANSION RINGS.

The centre from which the requisite elasticity is obtained will adapt itself to uneven surfaces to which it may be applied, and allow expansion and contraction to be fully taken up. The covering, being of Asbestos Cloth, imparts a protection to the centre, and so prolongs its elasticity. For Manhole, Mudhole, Steam-Pipe, and Mash-Tun Door Joints it is unequalled; and if applied as directed, a ring can be used many times over.

Price **6s.** per lb. in Sheets. Rings made up to Template, **9s.** per lb.

Made from 1-Ply for Cylinder and Faced Joints to any thickness for Uneven Surfaces.

Illustrated Priced Catalogues, with numerous Testimonials from Leading Firms, free on application.

118, SOUTHWARK STREET, LONDON, S.E.

CARDIFF: West Bute St. BIRMINGHAM: 7, John Bright St. HULL: Humber Dock Basin. GLASGOW: 35, Robertson St.

"THE METEOR."

NEW HIGH-POWER GAS-LAMP, WESTPHAL'S PATENT.
MOST INTENSE WHITE BRILLIANT GAS LIGHT.
MOST ECONOMICAL, SIMPLE, AND DURABLE.
DOES NOT GET OUT OF ORDER.
RIVALS THE ELECTRIC LIGHT.
NO ALTERATION REQUIRED TO EXISTING FITTINGS.
BURNER, BEING A CIRCULAR SLIT, DOES NOT CHOKE UP.

PARTICULARS & PRICES POST FREE.

HENRY GREENE & SONS,
SOLE CONSIGNEES FOR GT. BRITAIN & COLONIES,
153 TO 155, CANNON STREET,
LONDON BRIDGE, E.C.

WILLIAM INGHAM & SONS,

WORTLEY FIRE-CLAY WORKS
Near LEEDS,

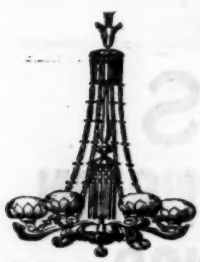
Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

1. Smooth interior, preventing Adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

PATENT
MACHINE-MADE GAS-RETORTS.

F. & C. OSLER,

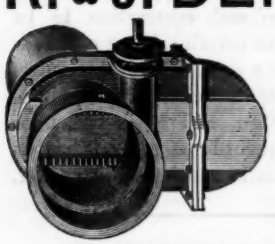
(ESTABLISHED 1807)

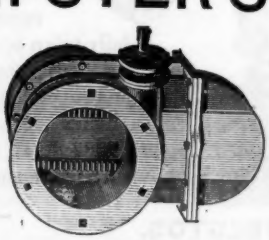


MANUFACTURERS OF CRYSTAL GLASS CHANDELIERS,
WALL LIGHTS, AND LUSTRES FOR GAS AND CANDLES,
TABLE GLASS OF ALL KINDS,
CHANDELIERS IN BRONZE AND ORMOLU.
MODERATOR LAMPS.

100, OXFORD STREET, LONDON, W.
MANUFACTORY AND SHOW-ROOMS:
BROAD STREET, BIRMINGHAM.

R. & J. DEMPSTER'S





TESTED GAS-VALVES.

The pinions of all our Slide Valves are now cut by special machinery from solid forgings. Valves of 10-in. bore and upwards are fitted with double racks, without extra charge. The flanges are all faced and made to standard dimensions, unless otherwise ordered. All valves are tested and guaranteed tight before leaving the works.

Upwards of 200 Valves kept in stock to facilitate quick delivery.

Prices and Dimension Lists sent on application.

All kinds of Faced and Hydraulic Centre and other Valves made to order.

GAS PLANT WORKS,
NEWTON HEATH, MANCHESTER.
London Office: 181 and 182, GRESHAM HOUSE, OLD BROAD STREET, E.C.

JOHN HALL & CO.,

STOURBRIDGE

MANUFACTURERS OF FIRE-BRICKS, LUMPS, TILES,

AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.
RETORTS CAREFULLY PACKED FOR SHIPMENT.
A STOCK OF DIFFERENT SHAPES ON HAND.

SULPHATE OF AMMONIA.

By Her Majesty's Royal Letters Patent.

DR. FELDMANN'S APPARATUS

The most successful and approved Apparatus known up to the present time.

FOR REFERENCES, PARTICULARS, TESTIMONIALS, AND PRICES APPLY TO THE

Sole Agents and Manufacturers,
GODDARD, MASSEY, & WARNER, ENGINEERS,
NOTTINGHAM,
OR TO
MAURICE SCHWAB,
96, DEANSGATE, MANCHESTER.

The Apparatus has been supplied to the following Firms—

BURT, BOULTON, & HAYWOOD, SILVERTOWN, and ELING.
CHANCE BROTHERS, OLDBURY (4 APPARATUS).
RUNCORN SOAP & ALKALI CO., Limited, RUNCORN.
NETHAM CHEMICAL CO., Limited, BRISTOL.
ANIMAL CHARCOAL CO., Limited, SHADWELL.
WM. BUTLER & CO., BRISTOL.
KEMPSON & CO., Pye Bridge.

And to the following Gas Companies and Corporations:—

ILKESTON.	BURY.	CHORLEY.
WIDNES.	BRIGHOUSE.	WHITEHAVEN.
HALIFAX.	MARKET HARBRO'.	CHESTER.
ALTRINCHAM.	PRESCOT.	SOUTH SHIELDS.
DENTON.	SOWERBY BRIDGE.	LEEK.
ST. ALBANS.	LEICESTER.	IPSWICH.
DUKINFIELD.	DARWEN.	BOURNEMOUTH.
NORTHWICH.	NELSON.	SALFORD.
HUDDERSFIELD.	ORMSKIRK.	LUTON.
		HAMPTON COURT.

GAS AND WATER PIPES

AND

CASTINGS OF EVERY DESCRIPTION.

MANUFACTURED BY THE

CLAY CROSS COMPANY.

CHESTERFIELD.

TRADE	TELEGRAMS:	LONDON AGENTS:
O X O	"JACKSON,"	BECK & Co.,
MARK.	CLAY CROSS.	53, QUEEN VICTORIA ST., E.C.

THE THAMES BANK IRON CO.

UPPER GROUND STREET, LONDON, S.E.,

SUPPLY FROM STOCK

CAST-IRON RETORTS

AND ALL KINDS OF GAS-WORKS APPARATUS.

SOCKET-PIPES FOR GAS OR WATER PURPOSES.

FLANGE PIPES FOR STEAM.

Sole Manufacturers of LYON'S 'PATENT' GAS MAIN SYPHONS.

AGENTS FOR

ATTERTON'S PATENT APPARATUS for CHARGING RETORTS.

WILLIAM GRICE & CO.

Ironfounders, Gas and General Engineers,

Fazeley Street Works, BIRMINGHAM.

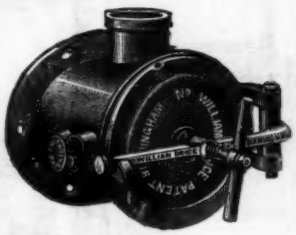
MANUFACTURERS OF

Grice's Patent Self-Sealing Mouthpieces.

To suit all sized sections of Retort. Over 70 stock sizes. Largely used in England.

Grice's Patented Stoking Machinery.

Made to suit large or small Gas-Works. The one machine draws the spent coke and recharges the Retort at one operation. Self-contained; working from engine on base or by hand. Price and particulars on application.



PURIFIERS, TANKS, PIPES, & OTHER PLANT MADE.

Machine-Moulded Spur, Bevel, Mitre, and Helical Wheels and Pulleys, to 20 feet diameter.

WROUGHT-IRON WAREHOUSE CRANES

As supplied to the English Railway Companies.

MORTAR & LOAM MILLS,

With or without Engines.

PUNCHING AND SHEARING MACHINERY

Of all Kinds.

ENGINES, Vertical and Horizontal; High and Low Pressure CONDENSING BOILERS; Tubular and Ordinary CASTINGS, All descriptions up to 15 tons.

CLAYTON, SON, & CO.

ESTABLISHED A QUARTER OF A CENTURY. LIMITED.

MANUFACTURERS OF ALL KINDS OF

GASHOLDERS

AND

GAS PLANT

OF EVERY DESCRIPTION.

LONDON OFFICE: 60, QUEEN VICTORIA STREET, E.C.

HUNSLET, LEEDS.

S. PONTIFEX & CO.,

GAS and WATER ENGINEERS,

Manufacturers of and Contractors for the Maintenance of

PUBLIC LAMPS & LANTERNS:

GLASS—Flint, Opal, and Bent in Stock, and Cut to Sizes.

WELL LAMPS, STREET NAME TABLETS,

LAMP COLUMNS, HEAD IRONS, PUTTYLESS LAMPS,

LANTERN COCKS, REGULATORS,

Improved High-Power Lanterns for Lighting Street Refuges and Open Spaces.

BROWN'S PATENT

LAMPLIGHTERS' TORCHES.

PROPRIETORS AND MANUFACTURERS OF

BOX'S PATENT

PUTTYLESS STREET LAMP.

This Lamp may be supplied fitted with clear opal, or ribbed glass, *as also with enamel tops* if required. The necessary fittings for altering existing Lamps to this system can be supplied at moderate prices.

S. PONTIFEX & CO., 22, COLEMAN ST., LONDON.

Works: 18, STEPHEN STREET, TOTTENHAM COURT ROAD, W.

JOHN BROWN & CO., LIMITED,

ATLAS STEEL AND IRON WORKS, SHEFFIELD,

ALDWARKE MAIN GAS COAL.

This Coal yields 12,600 feet of 19-candle gas per ton.

Weight of illuminating matter in pounds of sperm, 820·80. Very free from impurities.

JOSEPH CLIFF AND SONS,

THE ORIGINAL (ESTABLISHED 1795).

WORTLEY FIRE-BRICK WORKS,

NEAR LEEDS.

SPECIAL NOTICE.—Our Patent Machine-Made Retorts have now been thoroughly tested, and have proved themselves infinitely superior to those made by hand. At several large works it has been settled, beyond question, that, owing to the compactness and general excellence, more gas is sent to the gasholder from each ton of coal carbonized than is the case with hand-made Retorts.

AT THE PARIS EXHIBITION, 1878,

THREE MEDALS AND HONOURABLE MENTION

WERE AWARDED TO

JOSEPH CLIFF & SONS,

For their Various Exhibits, amongst which is a

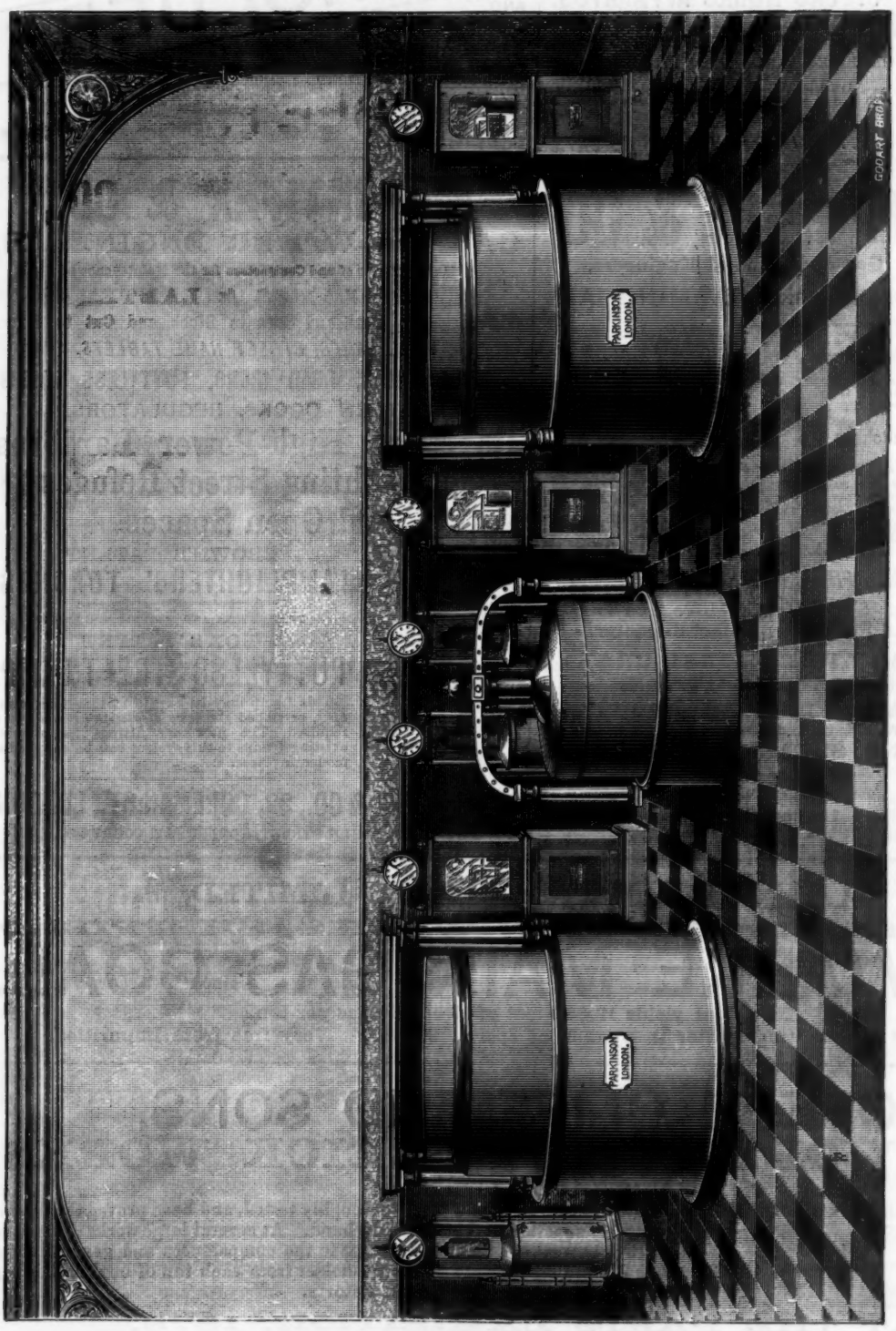
SILVER MEDAL FOR THEIR PATENT MACHINE-MADE RETORTS AND FIRE-BRICKS,

Being the Highest Honour given for this Class.

Lnodon Wharf: No. 4, inside Great Northern Goods Station, King's Cross, N. Liverpool: Leeds Street.

W. PARKINSON & Co.,

GAS ENGINEERS.



—VIEW OF GOVERNOR HOUSE—
AT THE
HAMPTON COURT GAS COMPANY'S WORKS, HAMPTON WICK,
SHOWING
PARKINSON'S GOVERNORS, PRESSURE REGISTERS, AND AUTOMATIC PRESSURE EXCHANGERS,
Controlling the Supply of Gas to Hampton, Moulsey, and Teddington. E. PRICE, Engineer.

Manufacturers of

WET AND DRY METERS, GOVERNORS, PRESSURE AND EXHAUST REGISTERS, STATION METERS AND GOVERNORS, EXPERIMENTAL APPARATUS, &c., &c.

COTTAGE LANE WORKS, CITY ROAD, LONDON. TELEGRAPHIC ADDRESS: "INDEX LONDON."

[See also Advt., p. 844.

London: Printed by WALTER KING (at the office of Kirg. Sell, and Railton, Ltd., 12, Gough Square); and published by him at No. 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, May 7, 1889.